

JOURNAL
OF THE
BOMBAY
Natural History Society.

No. 2.]

BOMBAY, 1890.

[Vol. V.

NESTING IN WESTERN INDIA.

By LIEUT. H. E. BARNES.

(Continued from page 19.)

631.—THE WHITE-EYED TIT.

Zosterops palpebrosa, Tem.

The White-eyed Tit is extremely rare in Sind, but occurs more or less commonly throughout the rest of the Presidency. In most places they are, I believe, permanent residents, but are often overlooked, as during the breeding season they are only found in well-wooded secluded nullahs; but in Poona, where they are very common, I have found nests in the middle of cantonments. The breeding season extends from the end of April to about the commencement of September, but June is the month in which most nests are found. I do not think that they have more than one brood in the season, as up to the first week in June nests are few and far between, but after this date they become very common, and I have found as many as twenty nests in a morning in a single nullah. After the second week in July, they again become rare, an occasional nest only being met with, and this probably belongs to a pair of birds whose first nest has been robbed.

Mr. Davidson differs from me in this. He says:—"Judging from the numerous empty nests one sees, from which young have been hatched, while others contain eggs, I think they must have two broods."

Guided only by my experience in Poona, I should feel inclined to agree with him in this conclusion, as there I found nests from April to September; but in Saugor, Central Provinces, the breeding season is much shorter: in fact, except during the last two weeks in June and the first two in July, only an occasional nest is found. This period is much too short for two broods.

The principal reason that induces birds to breed at one particular time is, I suppose, the greater abundance of food suitable for feeding their young at that season, and in a district where these influences exist for a long period, birds would likely enough have two broods; whereas in less favourable circumstances they would restrict themselves to one.

The nest is cup-shaped, more or less deep. It is suspended as a rule between two twigs forming a fork, much in the same way as that of the Golden Oriole, to which it bears a marked resemblance, except of course in size. Sometimes the nest is suspended hammock-like from two or more hanging twigs, a leaf or two of which is often incorporated in the nest.

The nests vary much, but are always soft and delicate, although well and firmly made. The materials of which they are composed are fine grass, rootlets, tow, moss, &c., bound together with cobwebs, thread, vegetable fibres, &c. Generally it is unlined, but sometimes it is well lined with silky down.

The eggs, three or four in number, generally four, are somewhat narrow oval in shape, pointed at one end, but broader varieties are not uncommon. They vary much in size, but usually they measure about 0.62 inches in length by nearly 0.47 in breadth. As Mr. Hume remarks in *Nests and Eggs of Indian Birds*, "abnormally large and small specimens are common;" they vary in length from 0.53 to 0.7, and in breadth from 0.42 to 0.58.

In colour they are pale, unspotted, glossless, bluish-white. Mr. Hume gives two as the normal number of eggs, but my experience is very different, as the following details will show:—During the

present season I have examined 63 nests; of these 28 contained four eggs or young; 14 contained three eggs only, but in several cases these were quite fresh, and possibly another egg would have been laid had I not interfered with the nest; the others contained one or two fresh eggs only. In Poona I never found more than three eggs in a nest. They build at various heights from the ground, in low bushes as well as in trees. As a rule they will desert the nest if it is only looked at, more especially if it is unfinished.

I caught one of these Tits with a butterfly net, at Poona, about the middle of September, as I wanted a specimen. About a fortnight later, I saw another in the same place, feeding a young one and teaching it to fly, and after a little searching I found a nest containing two others, so that the surviving bird must have hatched out and reared the nestlings unaided. I left them unmolested, but watched carefully to see if there was more than one adult bird, but from first to last, I never saw more than one. The one I caught was a female.

Poona, April to September.

H. E. Barnes.

Baroda, June and July.

H. Littledale, B.A.

Khandaish Ghats, July and August.

J. Davidson, C.S.

645.—THE INDIAN GREY TIT.

Parus nipalensis, Hodgs.

The Indian Grey Tit occurs sparingly at Mount Aboo, but does not appear to descend to the plains below. It is altogether absent from Sind, but is fairly common near Mhow and Neemuch, as also in Western Khandaish. It is very common at Poona.

They breed from May to August, rearing at least two broods in the season. The nest is a mere pad, composed of hair, moss and feathers, and is placed in a hole in a tree, wall, or bank. I once found a nest in the muzzle of an old cannon, and another in a hollow bamboo used as a rafter in the roof of an old outhouse.

The eggs, four to six in number, are broadish ovals in shape, measuring 0·71 inches in length by about 0·54 in breadth.

They are white in colour, pinkish-white when fresh and unblown, with an irregular ring or cap of red spots and blotches at one end (occasionally this ring is absent), with a sprinkling of purplish and

reddish specks scattered over the whole surface of the egg, principally at the larger end.

Poona, May to August.

H. E. Barnes.

Mhow, August.

Do.

Nassick, June and July.

J. Davidson.

646.—THE WHITE-WINGED BLACK TIT.

Parus nuchalis, Jerd.

The White-winged Black Tit has been obtained in Cutch and the vicinity of Deesa. It appears to be very locally distributed. It is probably a permanent resident where it occurs, but I can find no record of its breeding either in Western India or elsewhere.

647.—THE YELLOW-CHEEKED TIT.

Machlolophus ranthogans. Vig.

I shot a Yellow-cheeked Tit on the Vindhian Hills, near Mhow, which I identified at the time as this bird. I was only there a few weeks, and never met with another specimen, so that I do not feel quite sure that my identification was correct; the skin in question was sent to the Frere Hall Museum, and my label was never called in question. The differences between typical specimens of this bird and the Southern Yellow-cheeked Tit are slight, and they are bridged over by intermediate specimens that might with equal justice be ascribed to either of them. I saw other specimens at Neemuch, but as at that time I entertained no doubt in regard to the correctness of my identification, I did not shoot any. I never found a nest.

648.—THE SOUTHERN YELLOW-CHEEKED TIT.

Machlolophus aplonotus, Bly.

The Southern Yellow-cheeked Tit is a permanent resident on the Sahyadri Range and in the well-wooded tracts adjoining, and is very common at Aboo, and in the jungle at foot, but does not appear to extend far into the open country. I can find no accounts of its eggs having actually been taken within our limits.

I found a nest at Aboo on the 15th April, in a small natural hole in a tree; this I cut open, but the eggs had not been laid, although the nest seemed very complete. The Tits did not desert the nest, although I cut away a great deal of wood before I could get at the nest. I

had to leave the hill a couple of days later, so that I did not succeed in getting the eggs.

At Saugor in the Central Provinces, where the birds are very plentiful, I have taken many eggs.

As far as I know, the nests are invariably placed in holes in trees at varying heights from the ground, a favourite place being a hole cut by a Coppersmith (*Xantholæma hæmacephala*), which has already served the makers' purpose. Quite as often they choose a natural hole, which is always small, and entails a great deal of chopping and cutting before the contents can be appropriated. The nests are mere pads, composed of hair and wool, differing in no respect from those of the Indian Grey Tit.

The eggs, from four to six in number, are usually broad ovals in shape, averaging 0·675 inches in length by nearly 0·52 in breadth, but are subject to much variation, both in size and shape, as the following measurement of three eggs, taken at random from three separate clutches, will show: 0·67 by 0·53, 0·67 by 0·5, 0·62 by 0·53; this last appears almost spherical.

All the eggs in a clutch are of the same type. In colour, they are a glossless white (of a beautiful rosy-pink when fresh and unblown), more or less thickly spotted and blotched with reddish and purplish brown. These markings are occasionally more numerous at the larger end, but there is no tendency to form the ring, zone or cap, that is so prominent in eggs of the Indian Grey Tit.

When the markings consist principally of blotches, they are much redder and brighter than when they are composed of spots and specks.

If the hole is cut open before the eggs are all laid, and those already laid taken, they do not forsake the nest, but continue to lay until the full complement is completed, and I have taken an egg out of a nest on four successive mornings.

The breeding season extends from April to August: possibly they have two broods, but I found more nests in July than in any other month.

Aboo, April (nest).

H. E. Barnes.

Saugor, C. P., April to August.

Do.

Khandeish, May (nest).

J. Davidson, C.S.

660.—THE INDIAN CORBY.

Corvus macrorhynchos, Wagl.

The Indian or Bow-billed Corby is more or less abundant throughout the Presidency, with the exception of Sind, where it does not occur.

It is somewhat irregularly distributed, being apparently absent from some localities, in every way suited to it, and which are colonized exclusively by the Ashy-necked Crow (*Corvus splendens*), while in adjacent ones, the Corbies are the most numerous; in others again, both species are equally common.

They are permanent residents where they occur, breeding early in the year, commencing their nests in February, and by the middle of March their nesting operations are in full swing, all their eggs being as a rule hatched out long before the Common Crow begins to think of building.

The nest is of the usual corvine type, composed of sticks and stout twigs lined with hair, vegetable fibre, tow, &c., and is always placed in a tree.

The eggs, four or five in number, are moderately broad oval in shape, pinched in a little at one end, but both spherical and elongated varieties are not uncommon.

They vary a great deal in size, but the average of a large series was 1.73 inches in length by about 1.19 in breadth. In colour they are greenish-blue or dull sap-green, much spotted, streaked, blotched and smudged with sepia, blackish and olive-brown.

663.—THE COMMON INDIAN CROW.

Corvus splendens, Vieill.

The Common Indian or Ashy-necked Crow occurs abundantly throughout Western India, except on the higher ranges, where as a rule the Corby alone occurs. They breed from about the middle of May to about the end of June, making a ragged stick nest, lined with roots, &c., which is placed in a fork in a tree; the eggs, four or five in number, rarely six, are rather smaller than those of the preceding, which they greatly resemble, both in shape and colour. They are subject to much variation. It is in the nest of this bird, that the Koel (*Eudynamys honorata*) almost always deposits its eggs.

It is not unusual to find nests composed more or less of wires taken from soda-water bottles ; Mr. Blyth speaks of finding several, two exclusively so, and there is a nest made of the same materials in the collection of the Bombay Natural History, *vide* Journal, Vol. I., No. IV., p. 231.

Mr. Vidal in his "*Ratnagiri Birds*," gives the breeding season as April and May, and again in November and December, and expresses his conviction that they breed twice a year. This seems to be an interesting departure from the usual order, and I have not noticed anything like it in any other portion of Western India, but Mr. Davidson got numbers of nests in Kanara, along the coast, in October, but he did not notice any there in the early part of the rains.

664.—THE COMMON INDIAN MAGPIE.

Dendrocitta rufa, Scop.

The Indian Magpie, or more correctly the Indian Tree Pie, occurs more or less commonly throughout Western India. It is much more abundant in well-wooded tracts than in others. It is a permanent resident, breeding from the middle of March quite up to the end of July, but May and June are the months in which most nests are to be found. I think at this time of the year, they to some extent leave the plains and retire to the adjacent woods and nullahs, as many more nests are found in the latter situations, and the birds themselves seem to become more abundant, but as Mr. Littledale observes, "they are shy and wary birds ~~when~~ breeding, and the nests in the thick mango foliage are hard to find," they may in consequence often be overlooked. The nest is usually placed in a stout fork, near the top of a tree, not necessarily a high one. Mr. Davidson says that almost all he has seen have been on small trees. It is composed of twigs, those at the bottom being as a rule very thorny, and forming a sort of foundation, upon which the nest proper is placed, as a rule it is well lined with finer twigs and grass roots.

The eggs, four in number, occasionally five, vary most astonishingly, in both the ground colour, and in the character of the markings. Typically they are longish ovals, a good deal pointed

at one end. A common type is a pale salmon-white, thickly splashed and streaked with bright reddish-brown; another type is pale greenish-white, and the markings are olive and pale purplish-brown; others are intermediate between these two types; some of these are exact counterparts, except in size, of eggs of the Indian Grey Shrike (*Lanius lahtora*). In length they measure from 1·0 to 1·3 inches, and in breadth from 0·78 to 0·95, but the average is about 1·17 inches by 0·87.

678.—THE LONG-TAILED MAGPIE.

Dendrocitta leucogastra, *Gould*.

I am indebted to Mr. Davidson for the following note. I do not think that the bird has previously been recorded from Western India.

"This is, I think, a permanent resident in the Ghat portion of Kanara, but it is not a common bird. I have never taken the eggs, but I have seen the young just able to fly; the nest which they had left was on a small tree, about sixteen feet from the ground, in a thick clump, and was a very slight structure, much resembling that of *Dendrocitta rufa*."

The nest and eggs, according to Mr. Hume, do not differ from those of the Common Indian Pie.

681^{bis}.—THE LESSER STARLING.

Sturnus minor, *Hume*.

The Lesser Starling is a permanent resident in some parts of Sind.

The following interesting note is from the pen of Mr. Doig, who appears to be the only oologist who has succeeded in finding the nest:—

* "In February I shot one of these birds, and on dissection found that they were beginning to breed. Later on, early in March, I again dissected one, and found that there was no doubt on the subject, and so began to look for their nests.

"These I found in holes in Kundy trees, growing along the banks of the Narra, and also situated in the middle of swamps. The eggs were laid on a pad of feathers of the Spoon-bill (*Platalea leucorodia*), and the Pelican Ibis (*Tantalus leucocephalus*), which were breeding on

the same trees, their young then nearly fledged. The greatest number of eggs in any one nest was five. The first date on which I took eggs was the 13th March, and the last on the 15th May.

“ The eggs are oval, broad at one end and elongated at the other. The texture is rather waxy, with a fine gloss, and they are of a pale delicate sea-green colour.

“ The birds during the breeding time confine themselves closely to their breeding-ground, so much so that except when close to their haunts, none are ever seen.

“ The size of the eggs varies from 1·0 to 1·1 inch in length, and from 0·7 to 0·8 in breadth.

“ The average of 12 eggs measured is 1·03 by 0·79.”

683.—THE PIED PASTOR.

Sturnopastor contra, Lin.

The claims of this species to be included amongst the birds of Western India are very doubtful. Mr. Hume gives Eastern Rajpootana as one of the localities in which it occurs, and I saw it once near Khundwa; further east it is very common.

They breed abundantly in the Central Provinces during May and June, and the first half of July, making huge shapeless nests, composed of grass, straw, roots, &c., which are placed in high trees of various heights from the ground.

The eggs, six in number, occasionally only four or five (I once found seven), are moderately broad ovals in shape, pointed at one end. They vary enormously in size, in length from 0·95 to 1·25, and in breadth from 0·75 to 0·9, the average is 1·11 inches in length by nearly 0·82 in breadth.

In colour they vary from pale spotless bluish-white to pale blue, more or less tinged with green.

684.—THE COMMON MYNA.

Acridotheres tristis, Lin.

The Common Myna is very abundant throughout Western India, except, perhaps, in Ratnagiri and the extreme south, where it is replaced to a great extent by the Southern Dusky Myna.

They are very familiar birds, and are found in greater numbers near houses, being comparatively scarce in unfrequented jungle.

They are, of course, permanent residents, breeding as a rule from the middle of May to about the end of July.

In Kanara they appear to breed earlier, as Mr. Davidson has taken eggs there as early as the middle of April.

They are said to rear two broods during this period, but I am not at all sure about this, the time seems much too short; of course if their eggs are taken, they will lay again. They seem to breed almost anywhere, holes in trees, in walls, or in old masonry wells; in the roofs of houses, on the tops of pillars in verandahs, under the thatch of hay stacks and occasionally in deserted kite or crow nests.

Almost the first nest I found was of a compact cup-shape, and was composed of fine twigs and grass, neatly lined with grass roots and vegetable fibres; it was built in a fork in a babool tree growing in a hedge close to the Parsee Tower of Silence, Deesa, but I have never met with a similar nest since.

The nest is, as a rule, a most untidy shapeless affair, composed of grass, straw, roots, bits of rag, feathers, &c.

The eggs, four or five in number, generally five, are longish ovals in shape, pinched in at one end. In length they average 1.19 inches and in breadth 0.86, but they vary greatly, some eggs measuring as much as 1.3 in length, while others again are little more than an inch.

In colour they vary from a pale-blue to greenish-blue, and are usually highly glossy.

685.—THE BANK MYNA.

Acerotheres ginginianus, Lath.

The Bank Myna is very common throughout the province of Sind; it is equally common in Guzerat and parts of Rajpootana. Mr. Davidson reports it from Western Khandeish and Nassick, and I have seen it in the city of Bombay busily employed in excavating holes in the embankment of the Wodehouse Bridge, near the railway station at Colaba; they did not, however, breed there, as the boys persecuted them too much. They do not appear to occur in the Deccan or anywhere south of Bombay. They are omitted from Captain Butler's list of the *Birds of the Deccan* published in "*Stray Feathers*," Vol. IX., and Mr. Vidal does not include them in his "*Birds of Ratnagiri*."

They are as a rule permanent residents wherever they occur, breeding from about the end of May to the beginning of July, or perhaps later."

They bore holes in the sandy banks of rivers, sides of railway cuttings, embankments, and such like places, showing a decided preference for places close to water. These holes often communicate with each other, so that a bird entering at one hole can easily escape at another, but this is not always the case. I once found a small colony breeding in the sides of a well in company with a few pairs of the Common Myna.

The end of the hole, which is slightly enlarged, is lined with fine grass, roots, feathers, &c.

The eggs, four (occasionally five) in number, are pale spotless greenish-blue in colour, and average 1.05 inches in length by about 0.82 in breadth; they are, therefore, somewhat smaller than those of the Common Myna.

<i>Deesa,</i>	<i>May to July.</i>	<i>H. E. Barnes.</i>
<i>Hyderabad. Sind.</i>	"	"
<i>Neemuch,</i>	"	"
<i>Baroda, May.</i>		<i>H. Littledale, B.A.</i>
<i>Nowapur, Khandaish, March.</i>		<i>J. Davidson, C.S.</i>

686 bis.—THE SOUTHERN DUSKY MYNA.

Aerodotheres mahrattensis, Sykes.

The Southern Dusky Myna is common along the Sahyadri range and in the adjacent forests. Mr. Davidson says:—"It is common in Kanara and in the southern part of the Nassick district along the ghats. It becomes rare in the north of the Baglam talooka of that district, and I have never seen even an odd specimen which had crossed the small range dividing Nassic from Khandaish. I do not think it replaces the Common Myna. In Kanara the other is quite as common everywhere, and even on the line of ghats in Nassic, both species occur, as in Tanna and Bombay."

It occurs also in the vicinity of Belgaum. They are permanent residents where found, breeding during the hot weather from April to the middle of June. They nest in holes, in trees, stone walls, old buildings, chimneys, &c.

The nest is a shapeless mass of all sorts of material, grass, roots, fine twigs, dead leaves, moss, and lichens, lined with feathers, wool, &c.

This *omnium gatherum* is stuffed into the hole without any arrangement, about six times as much material being used as it is necessary, a hollow being left in the centre for the eggs, which are four or five (occasionally six) in number; they are usually longish ovals in shape, pointed at one end, and average 1·19 inches in length by 0·83 in breadth.

They are glossless, pale, spotless blue or greenish-blue in colour.

Individual eggs cannot be distinguished with any certainty from those of the Common Myna, but as a body they appear narrower and lighter in colour. Mr. Vidal, C.S., in his *Birds of Ratnagiri*, states that the Jungle or Dusky Myna (*Acridotheres fuscus*) is "abundant throughout that district, and more especially in the well-wooded tracts," but the species found there is generally accepted as *mahrattensis*. The two birds are very much alike, the only difference is that in *fuscus* the iris is yellow and in *mahrattensis* it is pale-blue, so that skins are not distinguishable.

687.—THE BLACK-HEADED MYNA.

Sturnia pagodarum, Gm.

With the exception of Sind, where it is very rare, the Black-headed or Pagoda Myna occurs more or less commonly throughout Western India.

They are permanent residents, breeding from the commencement of May to the end of July, or even later. They appear to breed earlier in Kanara, as Mr. Davidson obtained nests with young on the 15th May.

As a rule the nest is placed in a hole in a tree, but I have occasionally found them in holes in stone walls and old buildings.

The nest consists of a few scraps of dead leaves, grass roots, &c., lined with feathers or other soft material. The eggs, four or five in number, are oval in shape, measuring 0·97 inches in length, by about 0·75 in breadth. They vary in colour from bluish-white to greenish-blue. They are spotless and fairly glossy.

Deesa, July and August.

H. E. Barnes.

Neemuch, June to August.

Do.

Baroda, May and June.
Khandeish, June.
Nassick Ghats, May.
Kanara, May.

H. Littledale, B.A.
J. Davidson, C.S.
Do.
Do.

688—THE GREY-HEADED MYNA.

Sturnia malabarica, Gm.

The Grey-headed Myna is much less common than the preceding bird, and appears to be confined to the more hilly and better-wooded parts of the Presidency. It has been recorded from Belgaum and Ratnagiri, and is common along the coast in Kanara in jungles, and is found throughout the Satpooras in Khandeish. It occurs also at Mount Aboo.

I have often seen birds exposed for sale in the Bombay market, generally in company with the Black-headed Myna. The dealers assert that they come from Khandalla. I found a nest containing four young birds at Mount Aboo on the 10th June, but have never met with another; the bird even there is far from common.

The nests and eggs do not differ in any respect from those of the Pagoda Myna.

689.—THE WHITE-HEADED MYNA.

Sturnia blythi, Jerd.

I have never met with a specimen of this bird, but Mr. Davidson, writing from Kanara, has kindly furnished me with the following note:—

“ Mr. Hume was of opinion that this bird and *Malabarica* were one species. I am hardly convinced of it yet, though in the cold weather in Kanara a specimen or two of *Blythi* is frequently seen in a flock of *Malabarica*, and in the cold weather I certainly saw once two birds flying together, one of each kind. On the other hand, in April and May, when Mynas are breeding, all the pairs I have noticed above the ghats in Kanara were this species, and in the Satpooras in Khandeish, where *Malabarica* was occasionally seen, I never saw a specimen of *Blythi*.

“ I never obtained the nest, though I saw one fly into a hole in a very lofty tree in April. It seemed to have young, but the place was quite unapproachable.”

692.—THE SOUTHERN HILL-MYNA.

Eulabes religiosa, Linn.

I have never met with this bird except in a state of captivity, but Mr. Davidson, who has been more fortunate, has kindly supplied me with the following note :—

“ This bird is not at all uncommon in the heavy jungles, both above and below the ghats in Kanara. Its nests are, however, hard to find, and I only obtained three; one containing two moderately set eggs, in the end of April; the second containing three small young on the 6th May; and the third containing a single fresh egg on the 20th May. All were in holes in dead trees or branches, pretty near the top, one being in a dead supari tree, a most difficult place for any one to get at.

“ The natives told me that the bird invariably chooses dead branches to build in, but of course this is not proved.

“ The eggs are very handsome, of a rich blue, marked with large blotches of rusty-red towards the larger end. I have not got the measurement now.”

Mr. Hume says the only two eggs he has measured were respectively 1·37 by 0·9 and 1·35 by 0·87.

694.—THE COMMON WEAVER BIRD.

Ploceus philippinus, Linn.

This well-known bird is common throughout the district, on the hills as well as in the plains.

They begin to make their nests soon after the monsoon sets in, but it is not until the middle of the rains that many eggs are laid. They generally breed in company, but occasionally isolated nests may be found; but as a rule, I think these are never quite finished; at all events I have never found either eggs or young in them.

A colony engaged in building their nests affords a most interested and animated sight; they keep up an incessant chirping and chattering all the time they are working. Nests in every stage of construction, sway about at the slightest breeze, some scarcely begun, others so far advanced as to have eggs in them.

The nest, when finished, has been aptly described as retort-shape; the first portion, which is attached to the extremity of a twig, is

solid : this opens out into a bulb-like chamber, which is rounded off at the bottom on one side to form the egg compartment, the other side being continued downwards in the form of a tube, or spout, which forms the entrance. At the commencement the birds seem to work independently, but soon after the solid portion is finished the pair work together ; this part varies in length from three to six inches, or even more in length ; one bird (I think as a rule the hen) remains inside, the other flies to the nearest clump of sarpat, or other coarse grass, and returns with a long strip in his beak and alighting on the outside of the nest thrusts one end through ; the other bird pulls it tight, and then pushes the end out, which is seized by the bird outside, pulled tight, and again passed through, and so on, until the strip is used up, when it flies off for another. The method of obtaining these strips of grass is simple but ingenious ; the bird alights upon a stem of coarse grass, bites a notch in a blade, the exact depth required, and then catching hold firmly above the notch flies off, tearing the strip with it ; as the edge is very much serrated, the bird has to consider which end to pass through, and it is this that makes it so difficult to pull a nest to pieces.

The nest, when half finished, presents a very curious appearance, because when the birds have reached the part where the egg compartment is to be, they make a strong transverse loop, on one side of which the entrance tube will be formed, and the egg chamber on the other.

This has to be made very strong, because it will be used later on by the young brood as a perch. This part of the nest takes a long time to make, the birds being very careful over it, many nests being abandoned at this stage, owing to some imperfection in its construction. If the nest is not properly balanced, and perhaps to assist in steadyng it, they stick small lumps of clay on the inside. I have found as much as three ounces in six or seven pieces in a nest, but generally much less than this suffices. To see these pieces of clay properly, a nest should be cut open, and it will be seen that almost as soon as the bulb is commenced, the walls on two opposite sides are thicker than usual, forming the foundation of the transverse bar, becoming gradually thicker as it nears the bottom. If the nest

is cut down at this stage and reversed, it will look like a basket with a strong handle.

As soon as the chamber is finished, the eggs are laid, but the cock-bird goes on completing the tubular entrance, which is usually about six inches long, but is sometimes much longer ; one that I presented to the Society's collection is twenty-five inches and another twenty-four ; both of these are described in the Society's Journal, Vol. II., Part II., page 106.

A good deal of nonsense has been written about the Baya's nest : one writer affirms that it is commenced at the bottom, which is rested on a leaf ; another recent writer describes the nest as *non-pensile* when, as every griffin knows, it is a perfect type of a *pensile* nest.

Opinions differ regarding the use of the lumps of clay previously alluded to. A poetical rather than a practical notion prevalent amongst the natives is that the Baya uses them to stick fireflies to on dark nights to light up the interior of the nest ; another theory is that the birds use them to sharpen their bills upon.

Regarding the normal number of eggs, much difference of opinion exists, but I went carefully into this question before (see Vol. II., page 105 of the Society's Journal), and further experience has only tended to confirm me in my opinion, which is that the number of eggs is indifferently four or five, as often one as the other.

The eggs are pure, dead, glossless white, and vary a great deal in shape and size, but usually they are longish ovals, pointed at one end, and average 0.82 inches in length by about 0.59 in breadth.

I have myself never met with nests made of any other material than strips of green grass ; but in Ratnagiri Mr. Vidal found them made of coir, and in this case the nests were smaller than usual.

Mr. Hume and others describe nests made of strips torn from banana leaves and from the leaves of the date and cocoanut palms.

695.—THE STRIATED WEAVER-BIRD.

Ploceus manyar, Hors.

The Striated Weaver Bird, although very locally distributed, occurs in most suitable places in the Presidency. It has not been recorded from Ratnagiri, neither did Mr. Davidson meet with it in

Khandeish. It is very common in Sind and Northern Gujerat, and Captain Butler records it from Belgaum.

They breed towards the end of the rains, when the reeds and rushes have attained their full growth. The nest is somewhat similar to that of the Common Weaver-Bird, but owing to its being attached to the tops of a number of reeds, instead of to a single twig, the upper portion is much thicker. The tubular entrance is much shorter as a rule. All the nests I have seen have been composed of strips of grass-blades; although the nest is typically pendant, yet the leaves of the reeds and rush stems, are often to some extent woven into the body of the nest, affording it considerable stability, but this is I believe more the result of accident than design. The eggs, usually three, seldom four in number, are exact counterparts in shape and colour of those of the Common Weaver-Bird, but average rather smaller.

Deesa (Milana), August to September.

H. E. Barnes

Hyderabad, Sind, „

Do.

Belgaum, „

Captain Butler.

696.—THE BLACK-THROATED WEAVER-BIRD.

Ploceus bengalensis. Lin.

The Black-throated Weaver Bird seems to be confined to the more northern portions of Western India.

I met with it at Hyderabad in Sind and at Deesa in Northern Gujerat.

At Hyderabad I found what I thought were their nests, but have now reason to think that I was mistaken; at all events, as I had no gun with me, I could not shoot a specimen.

Captain Butler (now Colonel) in *Stray Feathers*, Vol. VII., page 184, records the following note:—

“ Not uncommon about Hyderabad and the country east, and I have noticed nests of all three species, the present, *philippensis*, *manyar* and *bengalensis* on the same tree.” I feel sure that he has made a mistake.

All the nests of Weaver Birds that I have seen on trees at Hyderabad were undoubtedly those of the Common Weaver Bird, and all the

nests of the Striated Weaver-Bird were attached to the tops of trees or rushes, on the banks of ponds or nullahs.

697.—THE BLACK-HEADED MUNIA.

Amadina malacca, Lin

The Black-headed Munia, within our limits, seems confined to the extreme south of the district. It is far from common in Ratnagiri, and is not uncommon among the rice fields along the coast in Kanara. About Belgaum it is a common seasonal visitant, breeding abundantly, during the rains, in the sugar-cane fields and amongst the reeds and rushes that fringe the border of the tanks and jheels, and along the banks of the rivers and nullahs.

The nests, composed of dry blades of grass, lined with finer grass, are globular in shape, and considering the size of the birds, are very large.

The eggs, four to six in number, are of a pure, dead, glossless white, and are elongated ovals in shape, much resembling those of the Common Munia (*Amadina malabarica*); they measure 0·64 inches in length by about 0·47 in breadth.

Kanara, August.

J. Davidson.

699.—THE SPOTTED MUNIA,

Amadina punctulata, Lin.

With the exception of Sind, the Spotted Munia is more or less common throughout Western India, but is as a rule very locally distributed.

They are permanent residents wherever they occur, breeding during the rains. The nest is very large, of a globular shape, and is usually placed six or seven feet from the ground, in an acacia or other thorny tree. The materials consists solely of broad blades of grass or bamboo leaves, and it is well lined with fine grass.

The eggs, from four to eight in number, occasionally more, are dead white, measuring 0·65 inches in length by about 0·45 in breadth. As is usually the case with pure white eggs, they have a delicate tinge of rosy-pink when fresh and unblown.

Khundelish, September and October.

J. Davidson, C.S.

701.—THE WHITE-BACKED MUNIA.

Amadina striata, Lin.

The White-backed Munia is not uncommon at Khandalla. I found three nests not quite finished in a thick foliaged tree, in a garden close to the railway station. Mr. Davidson found this to be the Common Munia in Kanara, both above and below the ghats, apparently building every month in the year, making a small round nest, of the type of *malabarica*, composed of grass, lined with materials of various kinds. The eggs are narrow ovals, and are generally four in number, occasionally five. The nests are generally placed in thorny bushes, three to ten feet from the ground. A very favourite place is also among the thorns, tied six or seven feet from the ground, round cocoanut trees, to prevent people climbing them.

703.—THE PLAIN BROWN MUNIA.

Amadina malabarica, Lin.

The Plain Brown Munia is very common throughout Western India, with the exception perhaps of Kanara. It is a permanent resident, and seems to breed the whole year through. The nest is a rather large loosely constructed sphere, made of fine grass, lined with still finer grass. The eggs, from four to ten in number, are rather broad ovals in shape, but are subject to much variation; they are of the usual dead, glossless white colour.

They measure 0·6 inches in length by about 0·47 in breadth.

I have often found nests built in the foundation of other large nests, such as that of the Tawny Eagle and Common Kite.

704.—THE RED WAXBILL.

Estrelda amandeva, Lin.

The Red Waxbill occurs more or less commonly, in suitable places, throughout the Presidency. It is common in some parts of Sind and in Gujerat, but it is more rare in the Deccan. They are permanent residents, breeding I think twice in the year, once in February and March, and again in October and November, making a rather large globular nest of grass, which however is very difficult to find, as the following note kindly furnished by Mr. Davidson will show:—

"The nests I have generally found on the ground, among thick tufts of grass or among reeds. It is composed of the very finest grass, and is very well concealed, and the hen slips away very quietly; indeed if it was not for the habit the cock has of carrying long pieces of grass to the nest, long after the hen has laid her eggs, I hardly know a nest that would be more difficult to find."

Neemuch, October.

H. E. Barnes.

Khandeish, March, October and November.

J. Davidson, C.S.

Nassick, February.

"

705.—THE GREEN WAXBILL.

Estrela formosa, Lath.

The Green Waxbill is very common on the Vindhian hills near Mhow, also on the Aravelli range. Mr. Davidson reports it from the Satpooras and from the foot of the ghats in Khandeish. It occurs, though somewhat rarely, in the Deccan. It has not been reported from any part of Sind.

They are as a rule permanent residents where they occur, but wander a great deal in search of food.

They are generally found in small parties even during the breeding season. I found them breeding at Mount Aboo at the end of the rains, but I did not take any eggs, as at that time I did not collect them.

Mr. Mortimer, who found them breeding at Saugor, has given me several of their eggs; they are broad ovals in shape, measuring 0·6 inches in length by rather more than 0·48 in breadth.

LIST OF BOMBAY GRASSES.

BY DR. J. C. LISBOA, F.L.S.

PART I.

(*Read at the Society's Meeting on 31st March 1890.*)

Gramineæ is an Order not so extensive as it is generally believed to be. It ranks third in the number of species, but its individuals are numberless. The study of grasses is a subject beset with many diffi-

culties, the spikelets or flowers, being small, nay often minute, and the glumes or floral parts of the same colour. Hence to distinguish one genus or species from the other genera or species, it is necessary to examine the number of glumes, their relative size, their position, their conformation and hairiness, and other minute characters, which demand constant use of the lens and microscope. The subject is so difficult that, in his Preface to the *Flora Australiensis*, Mr. Geo. Bentham, one of the most eminent English botanists, says :—

“ *Gramineæ* have been the object of special studies of several of the most eminent botanists, amongst which the labours of Brown, of Kunth, and of Trinius have been the most important. But the only general enumeration they have left is that of Kunth, who had not at that time the materials nor yet the leisure to investigate the synonymy, which had already become exceedingly confused. This confusion has been gradually increasing by the large number of species described in partial works, without that general comparison which is especially needed in an order in which a large proportion of the species have a very wide geographical distribution, and it has become more especially involved through Steudel’s more recent hasty and careless compilation (*Synopsis Plantarum Graminearum*). Nothing, therefore, is now more needed than a careful and judicious synoptical revision of the whole Order. Such a one is now in progress for De Candolle’s Monographs by my friend, General Munro, who has for a number of years made *Gramineæ* his special study, as well on living plants in tropical and temperate countries, as on dried specimens from the principal herbaria of the day, and in the correctness of whose views all those who have studied the partial memoirs he has published, feel fully convinced. Without his kind assistance the preparation of this part of my Flora would have been doubly laborious. He has, however, guided me throughout, and although I am far from holding him responsible for the generic and specific arrangement and characters here given, it is to him that I am indebted for many of them, and the whole have been the subject of discussion between us.”

Mr. J. F. Duthie, Director of the Botanical Department of Northern India, who has, by the direction of Government, devoted

special attention to Indian Botany, and particularly to the fodder grasses, in the preface to his book on "Fodder Grasses of Northern India," acknowledges having received much assistance from Prof. Hackel, of St. Polten, Hungary, a great living authority on grasses.

The study is hampered from want of a general treatise on *Gramineæ*, or a book on the Indian Grasses. It is true we have Steudel's "Synopsis Plantarum Glumacearum," published in 1855; but of this work, Mr. Bentham says the following in the Journal of the Linnean Society:—"The last general enumeration of *Gramineæ* was that of Steudel, who published in 1855 the first volume of his 'Synopsis Plantarum Glumacearum,' the worst production of its kind I have ever met with."

We have also Kunth's *Enumeratio Plantarum*. The first two volumes contain a description of grasses, which is, according to Mr. Bentham, far too hasty a compilation.

We have books describing almost all the flowering plants and even ferns growing in India and Ceylon, with their drawings, coloured, hand and nature-printed, but we do not possess a good treatise on Indian grasses. Roxburgh and Dalzell and Gibson in their respective Floras describe many Indian grasses, but there are several important omissions in them, as will be apparent from the list given below. Mr. Duthie's book, alluded to above, is a valuable contribution to the study of grasses, but he confines himself to the fodder grasses of a part of India only, and his descriptions of many genera and species are very short. He has given illustrations of 80 species, drawn by nature-printing process; but they would have been more valuable had they furnished dissections of the spikelets of each specimen.

Another difficulty in the way of the student of Botany is the want of a good herbarium, as in Calcutta and in various parts of Europe, where plants are well mounted and named. The advantages of an herbarium are best known by those who have had occasion to resort to it. Mr. Duthie in his abovementioned book thus describes in a few words the benefit he derived from the Calcutta Herbarium:—"My annual visits to the Royal Botanical Gardens near Calcutta have been of much advantage, more particularly in connection with the strictly botanical portion of this work. In addition to an

excellent library there is the splendid herbarium, in which grasses from all parts of India are largely represented."

In Europe investigators receive assistance from many learned men, but here in India very few scientists have leisure enough to devote themselves to the study of grasses, and those who may have formed these the subject of their study, are prevented from giving to others the benefit of their knowledge by their being frequently absent, or moving from place to place in the districts. In Poona, Mr. Woodrow, Professor of Agriculture and Botany in the College of Science, and one of the ablest botanists of the Presidency, has for the last four or five years endeavoured to secure a good collection of plants; but his collection of grasses is comparatively very small, some of which were examined by the late General Munro. Mr. Woodrow has not been able to identify the remaining from want of leisure. Now that Government have sanctioned an annual grant of Rs. 5,000 for the formation of an herbarium, I trust that Mr. Woodrow will employ skilful collectors to complete the Poona College of Science herbarium. Dr. T. Cooke, the Principal of the College of Science, who takes much interest in the welfare and progress of the Establishment, will, no doubt, give his valuable support, as he always does.

I refer to these difficulties, not with the view to enhance the value of my labours, but because the very mention of them will, I am sure, incite ardent lovers of nature to enter upon the field of investigation better armed and duly prepared. I may state here that those who wish to make new discoveries will find many opportunities, as the field is not yet exhausted, for, whilst this list was being drawn up, I received new grasses, which had not come under my observation before, and from those very places from which specimens were formerly sent to me. It happens very often that peons or other persons sent to collect grasses, not being themselves trained, gather large or beautiful and elegant grasses, not heeding the smaller ones, which probably grow under their feet or alongside the bigger specimens.

I am indebted to Mr. Wroughton, of the Forest Department, Poona Division, who, not being satisfied with sending me a good collection of grasses made by his assistants, himself succeeded in supplying me with many, some of which are amongst the rarest. When out in

the districts he never forgets to gather for me such plants and grasses as present an unusual aspect. It is thus that he obtained for me *Chloris tenella*, Roxb., stated by both Roxburgh and Dalzell and Gibson to be rare; the authors of the "Bombay Flora" saw it only at Surat, but Mr. Wroughton discovered it in the Poona district. In a letter sent to me, he writes to say:—"I have founded the delicate grass, *Chloris tenella*, specimens of which were sent to you, in the Loni Reserve on the banks of the Mutha Mulla river, but it is extremely local and by no means plentiful. Since I have found it on the banks of the Nira river in great abundance. Here it grows very luxuriantly. I had to wade through patches which were above my knees and covered a considerable area."

Mr. Madan, Forest Officer, South Thana Division, sent me a valuable collection of grasses from that locality, and this year he had the goodness to forward the duplicates with a packet of a scented grass named *podan*, *gande*, and *pandle*. This proves to be *Andropogon Hügelii*, Hack., a grass not mentioned in Roxburgh's "Flora Indica," nor in Dalzell and Gibson's "Bombay Flora." When in the last rainy season, Mr. Madan was at Satara, acting for Mr. Greathead, he took the trouble of supplying me with a great number of plants from that district, two of which appear to be new species.

In the well-prepared collection sent by Mr. Betham of Nassick and by Mr. Vishnu Mahadeo Tiluk, Range Forest Officer, Haveli, there are many interesting and rare grasses, such as *Arthraxon microphilus*, *Paspalum brevifolium*, *Eleusine mucronata*, and new species of *Trippogon*, *Aristida*, *Garnotia*, &c.

The collections received from the officers in charge of West and East Guzerat, and of the Panch Mahals, Sholapur, Satara, and also from Mr. MacNaughten, Principal, Rajkumar College, Rajkot, and from Mr. W. A. Talbot, of North Canara, are equally interesting.

My thanks are due to all of these gentlemen and to Mr. M. M. de Souza, attached to H. E. the Governor's establishment, and to Mr. J. M. de Souza, to that of the Superintendent of Mahableshwar, for their contributions of grasses from that hill, and also to the Rev. C. X. d'Abreu for a few plants from Goa.

These collections have afforded me convincing proofs that there is still ample field for research and exploration, and those students of Botany, who may think of devoting their attention to the study of grasses, will certainly reap a large harvest. The examination of these contributions has also enabled me to form a general idea of the grass vegetations of this Presidency, excepting Scinde,* especially of fodder grosses, and to furnish a reply to a reference received by me from the Director of the Land Record and Agriculture on the subject.

I am also much indebted to Mr. Duthie for valuable notes with which he has favoured me regarding some specimens of grasses which were submitted for his opinion in September last. Moreover he generously offered to send doubtful cases to Prof. Hackel for his identification.

In the preparation of this list I am much indebted to Mr. Shuttleworth, Conservator of Forests, N. C., through whose kindness I was able to obtain the abovementioned very useful collections of grasses in the various districts under his charge. I am grateful indeed for the ready assistance he kindly gave me, and for the trouble he took in writing to all of his assistants and recommending them to send me grasses.

Not being acquainted with the Conservator of Forests, S. C., I refrained from writing to that gentleman. I am sure he would have likewise assisted me with contributions from the districts under his charge.

I have to convey my special thanks to Mr. J. M. Campbell, C.S., Collector of Panch Mahals, who, on learning from me that I had taken up the subject of the study of grasses, encouraged me to carry it out on a more extensive plan than I had intended, and wrote to Mr. Shuttleworth to obtain for me through his assistants materials from his Circle. He evinced so much interest in my endeavours that in spite of his being very busy with his own arduous duties, he carried on for a short time a correspondence between himself and Mr. Shuttleworth on one side and myself on the other. He even assisted me in obtaining from different officials of Khandesh, *Rosha-grass* and its oil, about the quality of which I had some doubts. Mr. Campbell has done this

* I have seen a few from this place.

not so much out of friendship towards me as one might suppose, but with the view of rendering me assistance in my study. His desire of encouraging scientific and literary pursuits generally in this country, he himself being an ardent worker, is well known.*

In writing this Catalogue I have arranged the genera in accordance with the *Genera Plantarum* of Bentham and Hooker, the species being placed under each genus according to their affinities as I understand them. After the scientific names of the grasses in the list, I have copied the Vernacular names of almost all the grasses which were attached to the collections received from the various districts of the Presidency, to satisfy the curiosity of the reader. It is generally thought that every grass should have a name. This is an error, for very few grasses are known by their proper Vernacular names. As in European countries, so also in India, the same plant has different names in different provinces, nay even four or five in the same province or village, and the same name is not unfrequently given to a variety of plants and great many names to the same plant, *e. g.*, the Vernacular name of *Payen* is given to *Andropogon intermedius*, *A. odoratus*, *A. pertusus*, and *A. annulatus*, probably because they resemble each other, and have all their several spikes congested at the end of their culms. Vernacular names are often invented to please the *Sahib*, or to impress upon him the informer's knowledge: thus we have *Kali kussal*, *Panre kussal*, *Jungli kussal*, names given to grasses belonging to various tribes and genera, without any affinity, merely because the plants named are endowed with long awns. The fragrant roots of an *Andropogon* named *Khas-khas* are known all over India, but the plant itself has different names in different provinces; of course, rice, nachni, bajri, jawari and kodra are well-known, but there are several varieties of other cultivated grain plants, such as *Panicum miliaceum* and *P. miliare*, some of which even botanists themselves find it often difficult to distinguish by their Vernacular names.

* I apologise for my acknowledging with gratitude the kind assistance rendered me by the gentlemen above mentioned, as it is not usual to do so in a paper like this. I deem it my duty to convey publicly my thanks for the favours received. Since these notes were written, Government has passed a Resolution directing the three Conservators of Forests to supply me with specimens of grasses from their respective circles.

Bamboos are well known to people who work and deal in them in different districts, but even here the names vary in each province.

The names given are often fanciful to please the *Sahib*, as stated above. If, after the lapse of some time, the man be asked, he will give you a different name from what he had done previously. The names of some of the grasses written in the duplicates received this year are not the same as those which were assigned to the same plant last year. For these reasons I set very little value on them. For there is no certainty that these names before being attached to each species were verified by an intelligent person. Mr. H. C. Davidson, of the Revenue Survey Department, has collected grasses and herbs which grow in Alibagh on the fields amongst the rice, bajri and other food grain crop. After drying and mounting them properly, he attaches to each specimen a paper inscribing in a few words the uses and the Vernacular names after due enquiry. It is only by such means that we can ascertain the true Vernacular names, and render them useful to those who are desirous to know, and thus indirectly promote the advancement of the science of Botany. It is thus that their value in tracing the history of the plant may be enhanced. By the method adopted by Mr. Davidson we have before us a specimen of a plant with its well ascertained Vernacular name.

As to the Sanscrit names they are not more reliable than the Vernacular ones, being founded on less ascertained observation and description of the essential characters of the plants.

In regard to the uses of the plants, I have made use of the short statements of Mr. Duthie made in his "Fodder Grasses of N.-W. India" and of Mr. Fergusson in his "Catalogue of Ceylon Grasses," especially when my information did not differ from those statements.

Finally I submit this Catalogue, which for obvious reasons cannot but be brought out in parts, to the kind appreciation of this Society.

Additions and corrections, which may be made, and advice proffered, will be received with thanks.

GRAMINEÆ.

TRIBE—PANICACEÆ.

SUB-TRIBE—PANICEÆ.

Genus—Paspalum.

P. Kora. Willd., Roxb. *Fl. Ind.* I., 278, 279; Dalz. and Gibbs., *Bomb. Fl.*, *Suppl.* 97.

This is probably the wild state of *Paspalum scrobiculatum*. It grows in all districts, but not in abundance.

P. scrobiculatum, Linn.

Vern.—Koda, Kodra, Harih, Pakodi, Pakod. Cultivated all over the Presidency. The following is reproduced from my work, "The Useful Plants of the Bombay Presidency," which forms part of the 25th Vol. of the *Bombay Gazetteer* :— "Several varieties of this grain are mentioned by the natives, the differences in them being probably due to differences in the soil, method of cultivation, &c. Two sorts are, however, well known : the wholesome and the unwholesome. The former is smaller and paler than the latter, and goes by the name of *pakodi* or *hark* in the Konkan. In Goa it is called *Pakod*. The unwholesome variety is called *dhone* or *majari*, *hark* in the Konkan, and *mana kodra* in Gujarat. In Sanskrit it is named *Kodrava* (injurious). The grain is said to be the only poisonous part of the plant. Although the two principal varieties have been styled respectively wholesome and unwholesome, the arrangement is only one of convenience, for all the varieties are, as a matter of fact, more or less poisonous, and the highly poisonous seed of one locality, when sown in a different soil from that which produced it, may yield a grain whose properties have become either modified or intensified, according to the peculiarities of the localities."

Kodra grain is a common article of food with all the poor people in India. They prepare it by macerating it for three or four hours or more in a watery solution of cowdung, when the scum and the deteriorated grain which rise to the surface are separated and the good grain removed and spread out in the sun to dry. This process is repeated so long as any poison is suspected to remain in the grain. Boiling does not entirely destroy the poison, but if the grain is kept for a

number of years, its poisonous properties are found to diminish. When required for use it is ground in stone mills, and then pounded and winnowed, which process separates the different layers of the testa, and leaves the grain fit for use. Kodra is more readily cooked than common rice, and it is very extensively used in the Konkan as also in Gujarat, by men and cattle, mixed with whey, the latter being supposed to have the power of neutralising its poison. Notwithstanding all precautions, however, cases of poisoning do occasionally occur, though they seem rarely attended with fatal consequences. Surgeon-Major Pirie, who has described a case of Kodra poisoning (*vide* "Transactions of the Medical and Physical Society of Bombay," 1869, No. 9, New Series,) thus enumerates the symptoms :—

"Unconsciousness, delirium with violent tremors of the muscles, pupils dilated, pulse small and weak, skin cold and covered with profuse perspiration, and difficulty in swallowing." No mention is here made of vomiting, which is one of the earliest symptoms. Fourteen persons belonging to four indigent families were taken to him suffering from the above symptoms, which had come on about six hours after the Kodra had been eaten, and in extreme cases had lasted eighteen hours. All the persons recovered under emetics, stimulants, warm clothing and heat applied to the surface.

It will have been remarked by such members as belong to the Medical profession, that the symptoms given above are much like those of poisoning from datura, except the tremors, which are not met with in the last.

The regular use of Kodra seems to establish a sort of tolerance of the grain ; but it is believed by people that if partaken with black pepper, even by habitual consumers, deleterious effects soon show themselves.

The evil effects of unwholesome Kodra are far more severe in cattle than in man, due no doubt to their eating the grain, husk, &c., also to the absence of vomiting, an effect that almost always takes place in man. It proves fatal in quantities of about two and a half ounces to such large quadrupeds as horses, cows, &c. (more so to the former), and has also been known to kill buffaloes, goats, and asses. The active principle that produces these fearful effects has not, as far as I am aware, been yet isolated. Messrs. Duthie and Fuller

(*Field and Garden Crops*) attribute them to a ferment supposed to be generated in the grain, Drs. Pirie (*l. c.*) and Bonavia of Lucknow (*Ind. Med. Gaz.*) to a kind of fungus, which subsequent observers failed to detect. Dr. Lyon (*Med. Jurisprud. for India*) classes Kodra along with Darnel (*Lolium temulentum*) and *Lathyrus sativus* as a cerebral poison, and does not mention any fungus as being *present in the grain*.

Natives have various antidotes for Kodra poisoning. The most usual ones are gruel made of the flour of *urid* (*Phaseolus radiatus*), the stem of plantains, which is rich in tannin and alkaline salts, the astringent juice of the leaves of *Psidium guava* or the leaves of *Nyctanthes arbor tristis*. Whey has been mentioned before. It is used in Damaun and the neighbouring villages.

P. minutiflorum, Steud. *Syn.*—Gram 1, 17; Benth., *Fl. Austr.* 7, 461. All over tropical Asia. My specimens are from Poona, Nassick and Thana, where it is very common. It is eaten by cattle, especially when green.

P. brevifolium, Flugge; Kunt. *Enum.* 1, 48. *Panicum tenuiflorum*, R. Br.

Poona and Nassick, not common; also in N.-W. India and Australia. Uses as fodder grass unknown.

P. costatum, Hochst.

At Mahableshwar and Lanowlie: at the latter place not uncommon under the trees in the place known as *Lanowlie Woods*. It is an elegant grass, $\frac{1}{2}$ —1 foot high, with horizontal secund branches.

ERIOCHLOA, *Humb. and Kunt.*

E. annulata, Kunt., 1, 73; *Paspalum annulatum*, Trin., Sp. Gram., t. 133. It is rare, but is found at Chowpatty (Bombay), North Kanara, also all over India, Ceylon, and Australia.

ISACHNE, *R. Br.*

I. australis, R. Br. *Prodr.* 196.

Panicum atrorirens, Trin., Kunt. *Enum.* 1, 127.

P. antipodum, Spreng. *Syst.* 1, 314.

Vern.—*Doaria* or *Daurra*, Mez (Mount Abu). Common in Poona, Nassick, the Ghauts, and Guzerat. Also in other parts of India, Ceylon, and Australia. It grows in fields destroying the crops.

I. elegans, Dalz. and Gib., *Bomb. Fl.* 291.

Vern.—*Doonda*. Not seen by me.

I. Dispar, Trin., Sp. Gram., t. 86.

Is this Dalzell's *I. elegans*? Uses not known.

PANICUM, Linn.

P. sanguinale, Linn., Kunt. Enum. 1, 82.

P. Ægyptiacum, Retz. (A variety of the last). *Milium sanguinale*, Roxb., *Fl. Ind.* 1, 315.

Vern.—*Fakri* and *Fakria*. It is common all over.

P. ciliare, Retz., Kunt. Enum. 1, 82.

Vern.—*Kurad*, Sicka. A variety of *P. sanguinale*. Common in most warm countries.

P. commutatum, Nees in Linnea.

Is it a variety of *P. sanguinale*?

P. conjugatum, Roxb., *Fl. Ind.* 1, 282. First described by Roxb. as a distinct species. Dalz. and Gib., *Bomb. Fl.* 291, not seen by me. Is it a variety of *P. distachy whole*?

P. flavidum, Retz., Obser. IV. 15; R. Br. 198.; *P. brizoides*, Trin. Sp. Gram. t. 158; Roxb., *Fl. Ind.* 1, 293.

Dalz. and Gib., *Bomb. Fl.* 290. It occurs in Poona, Surat and throughout India and tropical Asia in general. Common on the plains and even on low elevations on the hills. It is reckoned a good fodder for cattle. The grain of this species, which is by no means scanty, is eaten by the poorer classes, and especially in famine times. It extends to Australia, and there it is found that its panicles lie prostrate from the weight of the grain. Prof. Church found that the fibre of this species is much more indigestible than that of any other. Its chief constituent is fat, or oil.

P. fluitans, Retz., Obser. III. 8; Kunt. Enum. 1, 78; Roxb., *Fl. Ind.* 1, 294; Dalz. and Gib., *Bomb. Fl.* 290.

P. truncatum, Trin., Sp. Gram. t. 68.

Vern.—*Pet-nar* (Bomb.); *Dossa* (Telling; name.)

It is found in Poona near water-courses and in moist situations, also all over India, and in the tropics of both the hemispheres, but not common.

P. erucæformæ, Sibth., *Fl. Græca*. t. 59; Kunt. Enum. 1, 78.

P. caucasicum, Trin., Sp. Gram. t. 268.

Vern.—*Shimpi, wag-hakt.* All over Bombay but not common ; also in other parts of India. Eaten by cattle ; considered to be a good fodder grass, but it is rather scanty.

P. prostratum, Lamb Illustr. 1, 171. ; Trin., Sp. Gram. 184, 185 ; Dalz. and Gib., *Bomb. Fl.* 290.

Vern.—*Sarpur, Chaurila.* Common in Poona, Guzerat, Surat, and throughout India, Africa, the West Indies and Australia. It is considered as a good fodder grass, and produces a considerable quantity of grain which is eaten by the people in times of scarcity. Cattle are fond of it.

P. helopus, Trin. in Spreng. Neue. Entad., 11, 84 ; Trin., sp. Gram. 183.

Urochloa pubescens, Beauv. Argost.

Urochloa panicoides, Beauv. 52, t. 11, fig. 1. Dalz. and Gib., *Bomb. Fl.* 290.

Vern.—*Kuri, Kuria.* It is reckoned to be a good fodder grass for both horses and cattle. The cultivated parts of the plains abound with it. It extends even to about 5,000 feet on the Himalayas.

P. cimicinum, Retz. Obsv. III. 9.

Milium cimicinum, Linn., Mant. 184.

Urochloa cimicina, Kunt. Gram. 1, 31 ; Dalz. and Gib., *Bomb. Fl.* 289. It is found all over India.

P. distachyum, Linn. ; Kunt. Enum. 1, 91.

P. subquadrifarium, Trin., Sp. Gram. t. 186.

Vern.—*Motia.* It is found in Damaun, Poona, and is scattered all over India, the Malayan Archipelego, and Australia, but rare. It is said to be cultivated in Australia for fodder, which it produces in large quantity.

P. colonum, Linn., Trin., Sp. Gram. t. 160.

Oplismenus colonus, Kunt., Enum., 1, 142 ; Roxb., *Fl. Ind.* 1, 296 ; Dalz. and Gib., *Bomb. Fl.* 291.

Vern.—*Borur, Shama, Sarvank, Pacad, Tor, Todia, Jiria.* Common all over India, Australia and many parts of America.

It is highly valued as an excellent fodder grass. It is even found on the Himalayas. It grows on well cultivated or rich soil. It is much relished by cattle. Its nutritive qualities are enhanced by its grain,

which yields in abundance. The grain is said to be sold in the bazaars of the N.-W. Provinces, and is much used by poor Hindoos on their fast days, but the higher classes do not set any value on it, and eliminate it from rice, with which it is often mixed by the dealers. Its succulent stems are said to grow from 2 to 8 feet in Australia.

P. Crus-Galli, Linn., R. Br. Prod. 191. Trin., Sp. Gram., t. 161, 162; *Oplismenus crus-galli*, Kunt. Enum. 143; Dalz. and Gib., *Bomb. Fl.* 292.

Vern.—*Bovur*, *Pacad*. Common weed in most hot and some temperate countries. It is similar to *P. colonum*, but coarse. The grain is not considered to be possessed of good nutritive qualities and is mostly consumed by the poorer classes. It is sown in the N.-W. Provinces for its grain, and in Rajputana used as fodder. It thrives well in Australia. In America it is highly esteemed under the name of "Barn Yard Grass." In his "Report on the Agricultural Grasses of the United States," Dr. Vasey writes: "It is greedily eaten (at Mobile, U. S.) by horses and cattle "and makes a hay of good quality. It is justly regarded as an "excellent grass, particularly before it ripens its seeds. In Louisiana, 'Mississippi and other States, it is mowed annually and yields as "much as four or five tons of hay per acre. Two cuttings are procur- "able each season when mowed as soon as it begins to bloom. It "re-seeds the ground, and requires no care save protection from live- "stock. Cows and horses are very fond of it, green or dry."

P. petiverii, Trin., spec. Gram. t. 176. In Poona and plains of Northern India. Rare. Cattle eat it. It is a good fodder.

P. myosuroides, R. B. Prod. 189.

P. angustum, Trin., sp. Gram. t. 334.

Vern.—(*Kora-Lom.*), *Pokalia*, *Didhina*, *musa-punchi*, *suphetkar*. It grows in Alibagh and on low wet ground. It is eaten by cattle with relish; it also grows in Queensland in Australia.

P. myurus. Lam.; *P. interruptum*, Willd., Kunt. Enum. 1, 86; Roxb., *Fl. Ind.* 1, 286.

Vern.—*Pokelia*. Not uncommon in Thana, Konkan, Ceylon, in warm wet ground. It is not a good fodder grass. In Australia, however, it is considered to be nutritious to cattle.

P. antidotale, Retz., Kunt. Enum. 1, 125.

Vern.—*Git, Sera, Male, Shamukha, Gharan, Ghamar, Girni, Mangrur, Baru, Barwari, Barigayli.*

It is a coarse grass, not generally considered to be a fairly good fodder grass, but is used when superior qualities fail. Mr. Coldstream reporting from Hissar states that it is grazed only when green, as it afterwards becomes bitter or saltish, and poisonous to cattle. Its smoke has the reputation of a disinfectant in small-pox and in healing wounds. In Madras it is used in throat affections. It extends to N. Australia.

P. repens, Linn., Kunt. Enum. 103; Roxb., *Fl. Ind.* 300.

Vern.—*Berod.* It grows all over Bombay and Northern India, and extends to Ceylon and Australia. It also occurs in N. Africa, South Europe, and on the coast of Brazil. Both horses and cattle relish it as a good fodder grass. Roxburgh states that cattle are fond of it. Mr. Ferguson in his "Grasses of Ceylon" says:—"It is indigenous to Europe, Africa, Asia and America, and in Ceylon grows equally well in the dry sandy soil, as it does in marshes or water, its long creeping underground stems enabling it to endure the hot dry weather. It is one of the most difficult plants to get rid of once it establishes itself in any locality, and in this respect resembles the *Triticum repens* of Europe. It is found from the sea up coast to Newera Eliya, and is a common weed on some coffee estates."

P. Roxburghii, Spr. Steud., Syn. Gram. 98.

P. tenellum, Roxb., *Fl. Ind.* 1, 309.

I am unable to describe it, as it is only marked in my note-book as having been seen on Malabar Hill some five years ago.

P. hermaphroditum, Steud., Syn. Gram. 1, 67; Benth., *Fl. Austr.* VII., 485.

Vern.—*Pokelia.* Thana, Konkan, and Poona. Uses not known.

P. radicans, Retz. Obs. IV. 18; *P. acrescens*, Trin., Spec. Glum. t. 88.; Steud. Glum. 1, 87. From the Collection in the Poona Science College.

P. deconpositum, R. Br. Prodr. 191., Benth., *Fl. Austr.* VII. 489.

P. pahulosum, Roxb., *Fl. Ind.* I 307.

Vern.—*Boruti* and *Kubus-nar*, Roxb. Not uncommon in Poona, Lanewli and Salsette.

P. plicatum, Lam. Enc. IV. 736; Trin., Spec. Gram t. 223.

P. Nepalense, Spr. Syst 1, 321, Dalz. and Gib., *Bomb. Fl.* 291.

P. plicatum, *P. costatum*, *P. nerrosum*, Roxb., *Fl. Ind.* 1, 311.

Parel and western side of the ghats; also in Ceylon up to an elevation of 2,000 feet.

P. montanum, Roxb., *Fl. Ind.* I., 313; Kunt. Enum., Plant 1, 126.

Ver. Lalket.

Thana, place named Khardi. Dispersed all over India as far as S. China. Uses not known.

(To be continued.)

DESCRIPTION OF A NEW MORPHID BUTTERFLY FROM NORTH-EASTERN INDIA.

BY LIONEL DE NICÉVILLE, F.E.S. C.M.Z.S., &c.

With Plate C.

STICHOPHTHALMA NURINISSA, n. sp.

HABITAT: Bhutan.

EXPANSE: ♂, 3·4 to 4·0; ♀, 4·5 to 5·0 inches.

DESCRIPTION: MALE. UPPERSIDE, *both wings* differ from those of *S. nourmahal*, Westwood, from Native Sikkim* in the ground-colour being of a much brighter shade, red chestnut instead of fuscous chestnut; in the broad fulvous outer band extending uninterruptedly from the middle of the costa of the forewing to the anal angle of the hindwing, being twice as broad on the hindwing, and not inwardly bounded as in *S. nourmahal* by V-shaped markings, which are obsolete, being reduced to obsolescent small rounded dots placed on the internervular folds. UNDERSIDE, *both wings* also with the ground-colour much lighter and brighter, the subbasal black line inwardly, and the discal black line outwardly, margined by pale

* Mr. A. V. Knivett has obtained three males and a female of this species in Native Sikkim two years running in August: it has also been recorded from Borneo.

greenish of a duller and less rich shade than in *S. nourmahal*. FEMALE differs in precisely the same way as the male, and in addition has the white spot at the apex of the forewing on the UPPERSIDE more than twice as large.

Described from numerous examples captured during the last three or four years in Bhutan by the native collectors of the late Mr. Otto Möller and Mr. A. V. Knuyett. Having lately had an opportunity of examining the true *S. nourmahal* in the latter gentleman's collection, I am able to describe the Bhutan species. The differences given above in the coloration and markings of the two species appear to be perfectly constant.

For the benefit of those who do not understand Arabic, I may note that Nur-mahal means "Light of the House" and that Nur-i-Nissa is "Light of Women."

PREHISTORIC BOMBAY.*

By W. E. HART.

THOSE who have walked about Bombay with their eyes open during the last twenty years must be struck with the changes which have taken place during even that short period, and which are tending entirely to alter the physical aspect of the island. As more houses are built, and more roads constructed in a space limited by the waters of the sea, what is closest at hand will be taken to furnish the materials of which they are to be made, and the ground on which they are to stand. So it is that we now see on all sides our hills being levelled, our hollows raised, and our foreshores reclaimed, till

* This paper was originally read by Mr. W. E. Hart, as a popular lecture, at the Sassoon Mechanics' Institute, Bombay, on the 10th March 1890. It is republished, here, as it is likely to be of interest to many members of the Society, inasmuch as it gives, in a convenient form, the result of the researches of such men as Buist, Clark, Wynne, Medlicott, and Blanford, collected from a large number of technical and scientific publications —Editor.

the whole island bids fair soon to be a flat oval, raised only a few feet above the sea. Then, when Lord Macaulay's New Zealander, educated into a cold-weather globe-trotter, arrives from the ruins of London Bridge at those of the Apollo Bunder, he will hear with wonder of Malabar Hill and Back Bay, and ask with incredulous surprise how they could ever have existed, or, having existed, whither they have disappeared. He will not however be in the plight of the traveller of the Eastern fable, who, on revisiting the same spot at intervals of a thousand years, and finding it, now a city, then a lake, and again an arid waste, was informed by the inhabitants on each occasion that it had always been as he then saw it. For, of the changes now in progress round us, the history will be preserved in many written records.

But I am to speak to you to-day of changes far greater than those now in progress, effected in the ages before there were any men on earth to write their record. How then, you ask, can I know of them? Well, I frankly admit I cannot *know*, in the sense of absolute certainty. But what is there we can so know? Even in matters of history, we are liable to be misled or misinformed through the partiality or ignorance of the human historian. This risk at least we escape in dealing with prehistoric times. For, as to them, there lies at our feet a book, written by the hand of Nature, in letters that cannot lie. True it is, we can open only a few of its pages, and possibly may misread the characters we find traced even on these. But that is the misfortune of the reader, not the fault of the writer. The whole truth is there, if we can decipher it, and one or two of these pages I ask you to turn with me to-day.

But before we do so, see how just a metaphor is that of the book. You all know that this globe of the earth which we inhabit is not a homogeneous mass from the surface to the antipodes, nor even all over its surface. The solid constituents of its crust are composed of different rocks, arranged one above the other in layers, or "strata," like the leaves of a book, and, like the leaves of a book, always in the same order. In some places some of the strata may be missing, as sometimes pages from a book. But you never find the order of the strata reversed. You never, for instance, find the chalk below the coal, nor the coal below the old red sandstone, any more than in

a book you find the second leaf before the first, or the third before the second. Though, digging through the chalk, you may, in some places, reach at once the old red sand-stone, without passing through the intervening coal, just as, in turning the leaves of a book, you may find the third leaf next after the first, if the second has been omitted by the binder.

Then, you know that from beneath this solid crust a mass of molten rock here and there finds a vent in volcanic outbursts, and streams over the surface in lava flows. Of these we shall have more to say in discussing the origin of Prehistoric Bombay.

But first I will ask you to take a glance at Bombay as she is. Standing on the rocky cliff, near the flagstaff where the English mails are signalled, on the east face of Cumballa Hill, near the north end of the ridge, you get, on a clear day, a fine view of almost the whole island, and see that it is roughly not unlike my left hand held towards you with the thumb and forefinger extended, and the other fingers closed. The forefinger is then the eastern side of the island, ending southward in the longer prominence of Colaba, while the shorter ridge to the west, ending southward in Malabar Point, is represented by the thumb. The space between them is Back Bay, while the Flats extend over my wrist to where the island ends at Sion on the east and Worli on the west, about a third of the way up my forearm.

Now look back along the ridge near the north end of which you are standing. You see it rises precipitously from the sea at the south end at Malabar Point, whence it gradually reaches an elevation of about 200 feet, and, with the exception of the depression through which the road passes from the Gowalia Tank to Breach Candy, it runs almost continuously for about 3 miles, till it ends precipitously to the north at Mahaluxumi. On the other side of the Vellard, it rises again at Love Grove, but is again breached by the depression at the Pumping Station, through which the main drain flows out. On the other side of this, it rises again in the Worli ridge, which ends precipitously to the north in the inlet of the sea at Mahim Bay, the south shore of which forms the sands, so well known to equestrans, marking the northern limit of our island on the west.

North of the bay, however, the rocky ridge rises again at Bandora,

in the island of Salsette, and is thence continued, with similar interruptions, northward along the coast, past Versova, Myr Island, Dharavi, and Bassein, to Arnalla.

This ridge on which you are standing then is part of a great sea wall of solid rock, here some half mile thick through from east to west, which protects some 35 miles of the western shores of India from the encroachments of the sea. Here and there, we have seen, it has itself suffered from the inroads of the waves. But how well it is calculated to withstand their fury, even during the onslaught of the S.-W. monsoon, to which it stands full exposed, you can see if you examine the rocks around. As the quarry-men at work below will tell you, they are so hard as to be incapable of "dressing," and require the finest steel-pointed crowbars for the making of the holes in which to put the blasting charges by which alone they can be rent.

Now, look again at the ridge on which you are standing. Through its whole length, you see, it rises precipitously on the eastern side, but slopes gradually to the west. The reason for this you will find presently, when examining more attentively the strata exposed by the operations of the quarry-men aforesaid. You will then see that these strata are not laid quite horizontally, but are tilted at an angle of some 15° from east to west. Yet they are all parallel to each other, so that the tilting force must have been applied to all alike, after they had been formed. This tilt, or "dip," as it is technically called by geologists, by unequally exposing the strata on the declivity to the action of the weather, has caused the gradual slope to the west. But before proceeding to a closer investigation of the structure of our island, let us look over its surface from our post of vantage. At our feet lies a flat expanse of low ground, some of it evidently below the level of the sea outside, which is excluded by the causeways at the Mahaluxmi Vellard, Worli, and Sion. It stretches from the base of the western ridge on which we stand, eastward, unbroken by any eminence, till it reaches the chain of rocky hills that mark the eastern limit of the island at its northern end.

This level plain, between the two lines of raised rocky ground on its west and east, is evidently of different formations; for

you see the southern portion, extending a short distance inward from the shore of Back Bay, over the quarters of Girgaum and Khetwady, is covered with a dense growth of cocoanut palms, indicating a sandy soil; while the bare treeless rice-fields, stretching away northward, show that we here have clay, till a patch of sand occurs again in the extreme north, as shown by the cocoanut palm groves that follow the curve of the Bay at Mahim.

A nearer though still superficial look at the soil in these places will show that the sandy portions are full of remains of sea shells, proving their marine origin; while remains of vegetation and estuarine shells in the clay portions show that they are formed of the mud deposited by tidal creeks.

But before descending to examine the Flats, look right across the island at the chain of rocky eminences that form its eastern shore towards its northern end. These, though not so high as that on which we stand, nor so unbrokenly continuous, yet seem to partake of its general characteristics. There is the same ridge shape, and the ridges lie in the same general direction, north and south. They also, like the western ridge, are steep on the eastern face, but decline gradually towards the west, and if you cross the island and examine the quarries there, you will find it is for the same reason. You see, too, regarding the eastern line of eminence as a whole, that, like the western, it is, generally speaking, higher towards the north than the south, where, indeed, on the Eastern coast, the rocky shore from Nowroji Hill to Colaba Point is raised very little above the sea. The reason, no doubt, is the same, *viz.* that the portion most exposed to the sea and weather, especially during the S.-W. monsoon, is most worn away.

The fact, however, that the lowest part of the eastern ridge at Colaba has been worn so much lower than the lowest part of the western ridge at Malabar Point, while the eastern ridge is neither so continuous nor so high as the western, shows that the rock on the east, though partaking of the same general characteristics as that on the west, is of a texture less suited to resist the action of the weather. This our friends the quarry-men would seem to say, when they tell us that the Sewri stone is good for building, as it can be cut to what form they please, while the Walkeshwar stone is

useless for building, as it is so hard that it cannot be cut, and will only break in such direction as itself chooses.*

But before we proceed to a more detailed examination, standing up here yet another moment, let us try to picture what would be the scene, were water spread over the surface now occupied by the flat plain below us. It requires no violent effort of the imagination to see that if the artificial dams at the Vellard, Worli, and Sion causeways, and the natural barriers formed by the heaping of sand-banks at Mahim and Back Bay were removed, so as to freely admit the sea, only the higher points of these two chains of rocky eminences on the east and west would escape submersion. But the soil that now connects them is, as we have seen, in part nothing but the clay deposited as silt by tidal creeks, and in part only the sea-sand heaped up by the waves and winds.

Here, then, is the first fact recorded on the first page, lying open at our feet, in the book of which I spoke. Bombay was not formerly one island as now, but a number of small rocky islets, ranged in two nearly parallel rows and separated by the waters of the sea.

That this was to some extent so even during their human occupation, is proved both by recorded facts and the tradition of local names, for we find Mahim mentioned in an ancient manuscript as a separate island; and from Dr. Fryer's account of his visit just 220 years ago, it would seem that Mahim, Worli, and Love Grove, were then all three separate islands; while Colaba consisted of two separate islands, the smaller of which, then called "Old Woman's Island," he describes as "a dry sandy spot, of no further value to the Company than as affording grass to their antelopes and other beasts of pleasure." Then again the name Umarkadi shows that, when it was bestowed, there was at Mazagon a *kadi*, or salt marshy creek. That it was shallow with a muddy bottom, is further evidenced by the name Paidhoni, given to that portion of the main

* Even on the eastern side of the island, however, a very hard black rock is found unlike either the Sewri or Walkeshwar stone. It occurs in small quantities and in isolated spots, which all lie in the same straight line between Sion Hill on the north and Cross Island to the south, showing apparently that it was all the result of one eruption under different conditions than those that formed the other rocks on either side of the island.

island at which way-farers, after fording the last creek, washed the mud from their feet before entering the town.

This single island of ours then, only two hundred years ago, was a group of at least seven distinct islets, and in the ages before that, ere the work of silting up had progressed so far as it had then, must have been an archipelago of what for the most part were little more than mere island rocks.

But the book we are reading carries their history yet further back. You remember I spoke just now of a dip in the strata at the quarry below Cumballa Hill. Now the same dip you will find, not only in the other ridge on the eastern side of this island, but in Salsette, into which we traced this very rock of Cumballa Hill on which we stand. Not only so, but it is observable in the other islands of the harbour, which together make up the Bombay group. These, with Bombay, would seem then once to have formed one continuous whole.

But the book does not stop there. If you cross the harbour, you will find this same dip on the main land, extending from some hills near Panwel, about 9 miles inland, to the sea, and running longitudinally up and down the coast, a distance of some 130 miles, from some way south of Bombay to near Damau in the north. It is especially noticeable here, because, with the exception of this small area, the stratification of the neighbouring rocks is for many miles remarkably level, though they are all of precisely the same formation as those that partake in the dip.

Originally, then, it would seem, this island of ours was not an island at all, but a portion of the main-land, and when broken off from that it became a cluster of small rocky islets.

What, then, was the force that broke this fragment from the main-land? Probably the same that produced the dip. That evidently might be caused either by an elevation at the eastern end, or a depression at the western. In the former case, there would probably be some dislocation of the strata about the line of up-heaval. But there is none visible. It therefore seems probable that the dip was caused by a subsidence in the west. But the general subsidence of a line of country near the coast would, of course, let in the sea over the lower portions and round the higher, so as to make islands

of what before were eminences on the main-land. These would be further worn down by the action of the weather and the waves, and thus tend to be united into one, like Bombay in her present form, by the deposit about their shores of the silt and sand formed by their own detrition.

But such elevation or depression, as that evidenced by the dip, of tracts of country, is effected only by volcanic agency. It would seem, then, that we owe our insular position to subterranean volcanic forces. How energetic these have been in past times we have abundant proof about us.

If we proceed now to a more minute examination of the rock at our feet, we find that it is heavy, hard, dark, crystalline, and on the flat upper surface curiously marked with a net-work of whitish veins into irregular hexagons. This points to a prismatic or columnar structure of the rock, which, together with its other characteristics, enables us to identify it with the class known to geologists as "basaltic," which are formed by the solidification of ancient lava flows. The columnar structure is not here so marked and general, nor so regular, as at the well-known Giant's Causeway in Ireland, or the Scotch Islands of Staffa and Iona, but unmistakeable groups of hexagonal columns do occur. The most accessible just now is that which overhangs the west side of the Pedder Road, a few yards to the south of the over-bridge at the Parsi Towers of Silence. But even where it is not fully developed in distinct columns, the prismatic structure can easily be traced in many places where the rock has been exposed in vertical section by the operations of the quarry-men. These also disclose the effect of decomposition through the action of the weather, and the percolation of water. First the mass splits into huge cubical blocks like those on the west side of the Queen's Road, just below the ridge of Malabar Hill. These splits take the line of the joints indicated by the network of white lines I have mentioned, which are perhaps formed by the infiltration of light coloured minerals in solution into the cracks caused by unequal shrinkage of the mass of glowing lava while it contracts in cooling. Where these blocks are allowed to lie undisturbed, in such a position as to be exposed to the atmosphere but sheltered from any violent action of the weather, they are found to be surrounded with a red

earth, the first result of their decomposition. As you go lower, this pales through orange into yellow, and the rock, further disintegrated by the mechanical action of the water filtering through the soil, as well as decomposed by the chemical action of such salts as it brings down with it in solution, is gradually loosened and broken up till the vertical prismatic columns become spheroidal or oval nodules, consisting of friable layers of a yellowish earthy crust, which you can peel off, like the coats of an onion, round a hard dark coloured nucleus, like the rock at the top. Lower still, even these lose their shape, and you find a mass of rotten brownish "moorum."

Now, if you cross the island to the quarries on the east, you will find the rock, as I have said, not so hard as that on the western ridge, nor does it show the same columnar or prismatic structure. These differences may have been caused by some difference in the conditions under which the mass of molten lava cooled at the different places. In other respects, the rock on the east generally resembles that on the west, both mineralogically and in the manner of its weathering into red earth, and finally decomposing through yellow nodules into brownish moorum.*

The rocky eminences of our island, then, would seem to have been originally formed by outpourings of volcanic lava, and their shape to have been determined by the force and direction of the flow. But these rocky eminences we have already succeeded in connecting with the main-land. You will, therefore, not be surprised to find, on crossing the harbour, that the neighbouring hills of the Coneau are also of volcanic origin.

But what is surprising is the immense area and depth covered by the lava flows that produced them. As you go inland from the coast, as you mount the western ghauts, as you cross the plateau of the Deccan, as you scale the heights of Mahableshwar, you find that the country for miles round, on all sides of you, is one great mass of volcanic rock, more than 6,000 feet thick, and covering an area of about 200,000 square miles! With the exception of that which produced the great basalt plain of the Snake River in Western

*But below this again, on the east side, in the excavations for the extension of the Prince's Dock, at a level which has not been reached at the bottom of the quarries on the West occurs massive rock: apparently identical with that at the top.

North America, covering an area larger than France and Great Britain together, there has probably never been in the history of the world so great an outpouring of lava as that which produced the series of rocks known to geologists as "the Deccan Traps," to which those of Bombay Island belong.

Besides the great depth and area occupied by these rocks, another peculiar feature about them is the extreme horizontality and regularity of their strata. With the exception of that dip in which the rocks of Bombay Island partake, and which we have seen to extend over a comparatively small area, the Deccan traps are found to lie in almost exactly horizontal bands, varying in thickness from 8 to 200 feet, formed by successive flows of lava.

This would seem to show that the vents through which the lava was ejected were raised little if at all above the surface of the ground, and that the lava streamed forth in a very liquid state, possibly as molten mud.

Considering the great area covered by the lava flows, very few of their vents have yet been found. Those which are known, lie principally in the plain of the Concan, and consist for the most part of what are technically known to geologists as "dykes," that is, long lines or walls of basaltic rock, showing that the lava of which it is formed was ejected from longitudinal cracks or fissures in the earth's crust. This, and the fact that the few crater-like vents yet discovered are little more than low hillocks, would seem to confirm the view that the lava flows forming the series of the Deccan traps were poured forth from but slight elevation.

The position of the known vents would seem to point to the conclusion that the scene of the eruptions that produced the Deccan traps was principally in the line of country between the foot of the western ghauts and the sea. There are, however, in Bombay several places to be noticed presently, which doubtless were the foci of volcanic eruptions later than those which formed the Deccan traps. These, as marking weak spots in the earth's crust, may also have been vents for the earlier eruptions, and others, by subsidence of the land, may now be lying beneath the waters of the harbour and the sea outside. However that may be, it seems pretty clear that much, if not all, of that enormous mass of volcanic rock which we know as

the Deccan traps was ejected in our immediate neighbourhood from a number of orifices in the surface of the ground, over the edges of which a seething mass of molten mud from time to time welled forth from below.

Now the bottom of this mass of volcanic rock is found to rest on certain strata geologically known as "the Bagh beds," shown by the fossils which they contain to be of marine origin, and identified with the rocks of the "Cretaceous Period" of Europe.

But the lava flows that formed the bottom of the Deccan traps were not deposited beneath the sea. For pent between successive flows, "interstratified" with them, as geologists say, are found strata of mud containing *fresh* water fossils. Moreover, the surface of the Bagh beds, on which the Deccan traps rest, is not all smoothly spread in level lines of horizontal stratification, as we should expect the bottom of the sea to be, but worn into ridges and hollows, as though it had been already elevated to the upper air, and exposed to the action of the weather before the first flows of lava were poured over it.

Again, the fresh water beds interstratified with these show that the first lava flows did not follow each other very quickly, for there was time for them to cool and harden, and by exposure to the weather to be worn into hollows, where were collected the water and mud in which those organisms, both animal and vegetable, that were killed by the next fiery flow passed their lives and were preserved in death.

Here, then, is another important fact recorded in our book. The oldest of the lava flows that form the Deccan traps is newer than the deposit of the Bagh beds, and was itself deposited in such manner as to be exposed to the action of the weather.

But after the formation of the fresh water beds interstratified at the bottom of the Deccan traps, the volcanoes would seem to have become more active, and the flows of lava to have followed each other in quicker succession. For through a great area and depth we find no more fresh water beds, and the bands of lava are found to rest on each other "conformably," as geologists say, that is, the upper are laid continuously and without disturbance on the lower. These facts show that the underlying bands had not been exposed

sufficiently long to the action of the weather to be worn into prominences and depressions before the deposit of those lying on them.

But the rocks of Bombay do not belong to this part of the series. For we find here no less than six bands of fresh water beds interstratified with the volcanic rock. Nor do they belong to the older parts in which the other fresh water beds occur. For with the exception of one out of several species of *Cypris*, a small crustacean allied to the "water flea," no animal organism among the fossils of the two sets of interstratified fresh water beds has been identified as common to both.

On the other hand, the fossils of the Bombay fresh water beds belong, apparently, to a later period in the history of the evolution of life on the earth than the others. We find among them the wing-cases of beetles, the bones of a fresh water tortoise, and the skeletons of a small frog (*Oryglossus pusillus*), which the absence of certain teeth shows to be closely allied to two existing species, *Oryglossus lima*, found in Siam, China and Bengal, and *Oryglossus laris*, found in the Philippines.

Here, then, is another very important record in regard to the age of our island, showing that its rocks were formed towards the end of the series of the Deccan traps, and when those volcanic outbursts were beginning to abate in frequency and violence.

But the Bombay fresh water beds you find on both sides of the island, and they run out into the sea at several places. Moreover, they are continued in Salsette, and, if looked for, would probably be found on the main-land. Wherever they occur they partake in the westward dip we have noticed in the volcanic rocks, the top or latest flows, of which they underlie.

All this tends to show that the fresh water beds were deposited before Bombay was so broken off from the main-land as we have seen, and that they originally extended beyond the present limits of our island. How far beyond, we cannot say, as we have no means now of knowing how much land has been lost by subsidence, by encroachments of the sea, and by the action of the weather.

Now the fossils which we find in the Bombay fresh water beds are such as show that the area which they indicate must have been covered by a shallow muddy swamp of stagnant fresh water.

For there is no trace of any fish, and besides the animal remains I have mentioned of amphibians and reptiles, minute crustaceans and insects, there are two species of fresh water molluscs and vegetable remains, consisting of small pieces of wood and numerous traces of marsh aquatic plants.

It seems, then, that towards the close of the geological epoch known as the Cretaceous Period, the whole of Western India was devastated by such an outburst of volcanic fury as the world has seldom seen. Of course, there were then no human beings on the earth. But, with this exception, the effect of that loosening of the infernal fires may in a measure be realized by the perusal of a very graphic account of a late volcanic eruption in Japan written for the *Cornhill Magazine*, and lately republished in the *Times of India*, from which I will read a few extracts:—

“ All around was beautiful on that bright summer morning, when at 7-30 there occurred an earthquake shock so violent as to leave no room for doubt that some mischief was brewing. Fifteen minutes later this was followed by a second and yet more severe shock. Another brief interval of about ten minutes, and the earth began to heave like a tossing sea, rising and sinking, so that houses collapsed, totally wrecked, and people were violently thrown down and became actively sick as if at sea. The earthquake was immediately followed by an appalling and unearthly sound as of the roar of a thousand thunder-claps, blending with the shriek of all the steam-whistles and roaring steam-boilers of earth, and, ere the terrified and deafened human beings could recall their bewildered senses, they beheld the whole mighty cone of Sho-Bandaisan blown bodily into the air, where it overspread the whole heaven with a vast dense pall of ashes and mud-spray, blotting out the light of day and turning all to thick darkness. Ere these had time to fall back to earth, there poured forth dark clouds of vapour and such stifling gases as well-nigh choked all living creatures. Then leaping tongues of infernal flame, crimson and purple, seemed to flash right up to the heavens, and after appalling earth-throes were succeeded by showers of red-hot ashes, sulphur, and boiling water, accompanied by fearful subterranean roaring and rumbling, and by a rushing whirl-wind of hurricane-force uprooting great trees and hurling

them afar. Another moment, and there poured forth floods of boiling liquid mud. Evidently the earthquakes must have rent some subterranean fissure, through which a great volume of water suddenly poured into the internal fires, generating a stupendous volume of steam, which must have continued to increase, and so become more and more compressed as volcanic fires and subterranean waters continued their awful struggle, converting the foundation of the mountain into a cyclopean boiler, which finally exploded, with the result, a million times magnified, of the most awful boiler explosion ever known above ground.

"The convulsions of the mountain rent great chasms, from which uprose jets of flame, ashes, and boiling water. The eruptions continued for about two hours. By 10 a.m. its violence was spent, though for hours afterwards the ground trembled and quivered, as well it might after so appalling a fit of passion. But in those two hours the whole face of thirty square miles of country (in the form of a vast fan extending to a radius five miles from the central crater) was totally changed. Of the mountain cone thus suddenly transformed into a steam-boiler, there remains now only the back—a ragged overhanging precipice, rising to a sheer height, variously estimated at 600 or 1,000 feet above a bottomless crater of about a mile in diameter. Thence, with ceaseless roar, rise dense clouds of suffocating sulphurous steam, which sometimes clear off sufficiently to allow adventurous climbers a momentary glimpse of the seething mud below. Those who have ascended that remnant of the mountain from the slope behind it, and so have reached the brink of that precipice have beheld such a picture of desolation as seems scarcely to belong to this earth. All that was Little Bandai now lies outspread in a thick layer of horrid mud, varying in depth from 10 to 150 feet—deep enough to efface every accustomed feature in the whole area—and itself partially coated with layers of pale grey ash and black stones and rocks, which seem to have been ejected to such a height as not to have fallen back to earth until the awful mud-wave had poured itself out. It is now described as a wild chaos of earth, rock, and mud, in some places resembling the concrete blocks of some cyclopean break-water—in others rather suggesting a raging sea whose gigantic waves have suddenly been congealed. Of all that made the scene

so beautiful and pleasant not a vestige remains—not a blade of grass where lately the mountain was clothed with springy turf, not a green leaf, not a sign of life, nothing but desolation, with a horrid smell arising from stagnant sulphur pools. Great trees, with their trunks twisted and split, lie uprooted and hurled far from the spot where they have stood perhaps for centuries, while of the villages on the mountain not a trace remains—they and their inhabitants lie buried deep beneath this hideous sea of mud."

If such was the scene when 30 square miles of land were whelmed beneath a stream of volcanic mud 150 ft. thick, flowing from a single crater, try to imagine what it must have been when with scores of lava vents in full operation, the same calamity occurred over a space 700 times as large, not once or twice only, but at intervals extending over many years, till the wide territory subjected to it was buried 40 times as deep as the fair fields of Bandai.

Even when the land began in a measure to recover from the effects of these outbursts in the intermissions of their fury, and plant and animal life was again developed on its surface, again and yet again the deadly torrent burst forth, overwhelming in sudden death the young beginnings of life that had just struggled into existence.

In this way were piled up on the main-land new hills of lava on the site of the swamps that filled the depressions worn by the weather in the surface of the flow that last preceded them.

But even when these were cooled and solidified into rock, volcanic fires still broke forth at intervals. For we find at several places in the island, notably Sion, Sewri, and Bhandarwara, as well as at the hill in which are excavated the Kanheri Caves in Salsette, and even at the bottom of the harbour in the tideway outside the Prince's Dock, masses of volcanic ash embedding fragments of the older volcanic rock torn off in the later eruptions, which are seen in places to have broken through the strata of volcanic rock and fresh water beds alike.

Then came the subsidence of a whole tract of country that plunged the western extremities of the continent beneath the waves, and cast her hills into the sea to become a cluster of island rocks.

Now turn another page of the record at our feet. You remember we saw the soil of the Flats, which form the centre of our island, to

consist in part of estuarine clay, and in part of marine sand. The former must have been deposited when Bombay was a group of islands separated by tidal creeks, such as we see to this day in abundance about Salsette and the coast of the Concan. It contains numerous roots of mangrove bushes bored by a species of teredo, showing that the soil in which they grew was a muddy salt marsh half way between high and low water marks. The marine sand, in places caked together into compact masses, to which the name has been given of "littoral concrete," consists almost wholly of sea shells that lived below low water mark. But, where both are found together, the low tide sand is found *above* the half tide clay, and in this order both are found together in places above high water mark.

But this is not all. At a spot in Byculla, 20 feet above the level of the sea, has been found below the clay that underlies the littoral concrete, a band of brown earth, evidently a salt water deposit, for it contains nodules of lime enclosing shells of the thin oyster, which from its position must be older than the blue clay, but from its appearance must have been exposed to atmospheric weathering.

Here, then, is another strange fact recorded in our book. After the volcanoes had so piled hills as we have seen on the fresh water swamp on the main-land, and these had by a subsidence of the coast been broken off the main-land and cast into the sea as islands, and had there lain undisturbed long enough to allow the deposit of the silt which forms this band of brown earth, there came an upheaval of the land that raised the floor of the sea above high water mark and exposed it to the action of the weather. This was followed by another subsidence that brought the band of brown earth below the level of half tide mark long enough to allow the deposit on it of the mud of tidal creeks and the growth of mangrove forests. Then again the land sank down, till what had been salt marsh became deep sea, and on the estuarine clay was deposited the shelly sand of the littoral concrete. Then another change, this time an *up*-heaval, and lo ! brown earth, blue clay, and littoral concrete, are together pushed up *above* the level of the highest tide !

This change in the level of the Flats, for a reason I shall presently point out, probably pushed them up considerably higher than they now are, and possibly connected all the rocky islets in one. If so,

there must have been another subsidence. For, as we have seen, Dr. Fryer, 220 years ago, found the island no longer one. If that subsidence is still continuing, as seems not improbable, we would appear to be on the way to being slowly submerged, and are doing our best to aid the efforts of nature in this direction by cutting down all our hills! On the other hand, if the waters around us are not being deepened by a subsidence of their floor, we are in danger of being silted up by mud and sand, if not lifted bodily back on to the mainland by another upheaval. In either event farewell to Bombay's greatness as a maritime port, even if she escapes destruction by another eruption, the possibility of which is at least indicated by her past history, and these continual upheavals and depressions, which can only be the work of volcanic forces!

But, as the novelists say, I anticipate. Besides, I am wandering away from my subject, which is connected with Bombay only in the past tense, not in the paulo-post-future.

To return to the last upheaval that brought the shelly sand of the ocean's floor to the surface of the dry land, that it occurred in what geologists (whose computation of time is not by years, but by cycles of ages) call "recent" times, is shown not only by the fact that the shells of the littoral concrete are such as we find on our shores to-day, but that in the brown earth which underlies the clay below it are found unmistakeable traces of human occupation. This brings us to the last page that has yet been opened of our unwritten history, where we find traced in clear characters the word "Man," which makes the facts recorded on it, though not so surprising as some we have already learned, yet, perhaps, of more personal interest to us.

Some twelve years ago, while the excavations were being made for the Prince's Dock, Mr. George Ormiston came on the remains of what was evidently a submerged forest, 32 feet below high water mark. Nearly 400 trees in all were found, of which 223 were still standing erect, and 159, though prostrate, were still rooted in the soil. This was a shallow band of brownish earth, apparently identical with that which we have seen to exist at Byeulla, for it seemed to be of marine origin, but altered by atmospheric weathering, and immediately underlay the blue estuarine clay in which the trees were buried, and overlay the trap rock. The trees were all a species of

acacia (*Acacia Catechu*), known to the natives as *khair*. It, of course, never grows at any spot below high water mark, and is now found in great quantities in the jungles about Badlapur, on the lower spurs of the western ghauts, at a considerable elevation above the sea.

Here, then, is a very clear record of a decided upheaval and subsequent subsidence. Judging too from the nature of the trees found in it, it would seem that the brown earth deposited by the sea must have been pushed up considerably higher than the present level of the littoral concrete which overlies the blue clay above, and have been allowed there to rest undisturbed for a time sufficient to allow the growth of these trees, the largest of which was 46 feet long, and 4 feet 8 inches in girth.

Then followed a subsidence sufficient to allow of the trees being completely covered by the muddy silt of the harbour. This was apparently effected rapidly, but without any great or sudden rush of water. For all the fine twigs were found preserved in position in the clay, the lower portion of which contained no shells, as the upper did,* while the borings of the teredo worms that had perforated the standing trunks were found to extend for only about a foot downwards, and the rat-holes at the roots of the trees, though filled with mud that exactly preserved their shapes, yet contained no remains of drowned or smothered rats.

None of the trees bore any marks of having been felled or cut, but among them was a log certainly charred by fire. The burnt portion showed by its shape and position that it had been laid with its centre across the fire. What the makers of the fire were doing there does not appear. Certainly not cutting wood, though they might have been gathering the pods to get catechu, if its properties and uses were known to them. Nor do they seem to have been permanent dwellers

*This shelly upper portion is also much darker in colour, and very offensive in smell, so much so indeed that on being first dug into, both at the time of the first excavation of the Prince's Dock and of its subsequent extension, many of the workmen sickened, and fever was very prevalent among them. Apparently the upper or later part of this clay deposit was charged with the sewage of the city, which, since the construction of the railway embankments at the north end of the harbour, has been deposited more rapidly and in greater quantities than when the openings there allowed a through "scour" in a free passage for the sweep of the tide and the creek currents round the north of the island.

on the spot. For except the charred wood, apparently the remains of a camp fire, there was no other trace of human occupation.

Possibly they were a party of belated fishermen or oyster-catchers spending the night in the shelter of the trees, which, though they may have been at a considerable elevation above the sea, were certainly not far from the coast, for on the gravel in a crevice of the rock was found an oyster shell.

Again, when fresh excavations were being made by Sir Thomas Thompson last year for an extension of the docks, two or three more trees were found, among which was another log, charred much in the same way as the first. These are, however, eclipsed in interest by a specimen which Sir Thomas has kindly lent me for exhibition to-day. It is one of two covered stone jars† found on the level of the soil in which the trees were rooted.‡ As they were standing right side up with their covers on, it seems unlikely that they were dropped from a passing boat. If not, they prove conclusively the presence of man on the spot at the time the submerged forest was above water. The man, however, was not far advanced in civilization, or his jars would have been of pottery or metal, or, if of stone, more smoothly finished. Nor does he seem to have been a permanent inhabitant of the place. For there are no other traces of his occupation than the remains of this fire and his two jars, and the stone of which the latter are made, though doubtless of volcanic origin, like almost all the stone for hundreds of miles round, differs in colour and texture from any found in Bombay.

Here, then, are traces of another, or perhaps the same, party of

† These jars were nearly spherical in shape, but with flat bottoms, roughly hewn and hollowed with some narrow angular pointed tool, the marks of which were not smoothed off. The covers were stopper shaped and fitted loosely in the mouths.

‡ So I was told by Sir T. T., but this seems to be a mistake, for I was told by Mr. Ormiston, after the delivery of my lecture, that Mr. Lynn, the Engineer, pointed out to him a spot in his plan and section of the works as the place where the pots were found, from which it would seem they were lying only a foot or two below the top level of the blue clay, and must therefore have been buried long after the subsidence, and were probably dropped from a passing boat. This does not, however, detract from the evidence (of the charred logs that the subsidence took place in the Human Period, or tend in any way to show that Bombay itself was then permanently inhabited by men.

occasional visitors, who, on going away, forgot to take with them some of the utensils they had brought. These bear no signs of fire, and could not, therefore, have been used for cooking. Their weight is so great in proportion to their capacity, that I doubt if they were intended to be used as receptacles for articles to be carried any great distance, and they are too small to have been used for storing. Moreover, when found, they contained nothing but mud. It seems then they were intended to hold something easy of consumption, or difficult of preservation, not intended to be carried any great distance. They might, therefore, have contained the food or drink of some person paying a short visit to the uninhabited island from some neighbouring place. That no traces of such visits are found elsewhere than close to the eastern shore, would seem to show that the object of these prehistoric picnickers was the capture of fish or the collection of oysters, and that they came from the East.

Shortly, then, to sum up what we have spelled out from the pages of our ancient book, we find that the spot on which we stand, and which we are fond of speaking of as "*Prima in Indis*," is in fact one of the *last* made, and *last* inhabited. For we have seen that the rocks immediately around us were the latest fashioned on these coasts. We have seen how the foundations of our thriving city, now so picturesque and pleasant, were laid in scenes of desolation and death, amid the horrors of heaving earthquakes, when the land was rent by the fury of volcanic fires, and swept of life by glowing lava floods. We have seen how these were followed by brief intervals of peace, in which the earth, all scarred and shaken as she was, strove once more to clothe herself in her mantle of green, and sustain the young life of her new-born creatures on her bounteous bosom; but how these were again and again engulfed in fiery death, and buried in successive flows of molten rock, that piled rows of bare arid hills on what had been a level fresh-water plain, a dreary swamp perhaps, yet teeming with vegetation and life. We have seen that when the destroying flood abated, volcanic fires here and there yet broke forth anew, and that the subsidence of more than 1,000 square miles of land upon the coast, perhaps by another effort of the Fire Demon beneath the earth, plunged the mountains of the main-land as islands in the sea. We have seen how this archipelago of rocks, though

peopled by no human inhabitants of its own, even after the appearance of man upon our globe, was yet trodden at times by the chance steps of stray visitors from other shores. Lastly, we have seen how, after being alternately lifted and lowered by successive upheavals and subsidences of the ocean's bed, a group of islets was at last joined in one by the banks of soil and sand furnished by their own waste, and Bombay, as a single island, rose as did of old the Goddess of Beauty, from the sea.

Am I not right in saying that a book in which we can read such tales as these is one whose every page is full of interest for us all? And does not a tale such as that we have just read prove how true was the word of him whose every word is truth, when he spoke of the "sermons in stones, and good in everything?"

But let me ask you to remember this. Ours is a book that he who would understand it aright must read with his own eyes, and ponder with his own mind. No disquisition, however clear, by any geologist, however able; no picture or plan by any draughtsman, however skilled; no lecture a hundredfold more learned and eloquent than this of mine; can teach you one tithe of what you can teach yourselves, if you only go afield with a humble and steadfast purpose to learn, and study the scenes around you for yourselves.

THE BUTTERFLIES OF THE CENTRAL PROVINCES.

By J. A. BETHAM.

(Continued from Vol. V., page 28.)

BEFORE enumerating the butterflies found in the Central Provinces. I would here state that the number in brackets, which will be found after the name of each butterfly, is that given to those which are described in Mr. de Nicéville's book, "*The Butterflies of India, Burmah and Ceylon.*" If a description of any butterfly is required, all that has to be done is to turn to the number in the book, and there a very ample, correct and lucid description of the butterfly,

with notes (in most cases) as to its habits, &c., &c., will be found. The few notes I am able to give are chiefly from personal observation of those butterflies that I have come across.

SUB-ORDER—RHOPALOCERA.

FAMILY—NYMPHALIDÆ.

SUB-FAMILY—*Danainæ*.

1. *Danais melanoides*, Moore (see *Danais aglea*, Cramer [16].—Of this butterfly I have as yet only one specimen, a male, taken at Jagdalpur, the capital of the Bastár Feudatory State. It has semi-transparent wings, very pale blue with black veins.

2. *Danais limniace*, Cramer [26].—This butterfly, with *D. chrysippus*, *D. genutia* and *Euplœa core*, is very common, is found everywhere, and can be taken nearly all the year round. It has pale blue wings with black veins. The wings are not so transparent as are those of the last-named species. It is a rather large insect, and has a lazy, sailing flight. The male has a pocket or scent-pouch in the hindwing, and protrudes from the anal extremity of the body two processes of a greyish colour which resemble bottle-brushes in miniature. When this is done an odour is perceptible. No doubt this is a provision of Nature to protect it from its enemies. It is a most difficult insect to kill, as are most of the *Danainæ* and *Euplœinæ*; a squeeze, such as would crush the life out of such a strong-bodied creature as a *Charaxes*, has no effect on it, its body is so leathery and tough. The best way of killing it, as far as I have had experience, is to put a drop or two of benzine on its body. It is easily captured, seemingly having very little fear of human beings. It is imitated more or less closely by several other species of butterflies, the ones most common in these parts being *Papilio dissimilis* and the female of *Nepheronia gaea*.

3. *Danais chrysippus*, Linnæus [28] with varieties *D. alcippus*, Cramer [29] and *D. dorippus*, Klug [30].—The typical *D. chrysippus* is the commonest and most widely spread of all butterflies in India, or at any rate, the one that strikes the eye more than any other. *D. alcippus* and *D. dorippus* are, I believe, only forms of *D. chrysippus*. During the time I have been in the Central Provinces (now nearly

14 years) I have only procured one specimen of each of these varieties; of the former I caught one in the public gardens at Betul in 1886, and of the latter one at the Marble Rocks near Jubbulpore, in the same year. I have a few specimens of what are undoubtedly *D. chrysippus*, in which the black coloration at the apex of the forewing is more or less obsolescent, and the red ground shows through; the gradations between this and the commoner form are almost complete, and pass from the deep black at the apex of the wing of the typical *D. chrysippus* through others in which the red begins to show through, till in some forms the red predominates and the black consists merely of a border. If either *D. alcippus* or *D. dorippus* were a distinct species, it would be found more generally distributed, and there would be no gradation from the type to the variety, the difference would be sharply marked and distinct. It may be that they are "sports" or "aberrations," as are albinos or melanoids among human beings and other creatures. I have other butterflies which present something of the same variation, for instance, a male *Nepheronia gaea*, in which the black border to the wings is about twice as broad as it is in an ordinary specimen, and a female *Irias marianne* in which the black border of the hindwing suffuses nearly the whole of the wing, nearly obliterating the white, although the same wing on the left side has the border of the normal width. *D. chrysippus* is the common tawny-red butterfly which one sees almost everywhere, and almost always, with a black apex to the forewing, behind which is a white band. It has a lazy flight and is easily caught. In some favoured spots they swarm in hundreds. The air seems full of them, and they can be seen settled holding on to the extreme ends of twigs or along them, thus trying to make one believe that they are dead leaves. These places are generally warm, dry spots under the shade of large trees. Various other butterflies among the *Danainæ* and *Eupliænæ* have the same habit. They are as difficult to kill as the last; a drop or two of benzine on their bodies, however, soon stops their struggles. *D. chrysippus* is more or less closely imitated by several other butterflies, the most wonderful being the female of *Hypolimnas misippus*. Col. C. Swinhoe, in one of the former numbers of our Journal (Vol. I., page 169, *et seq.*), has given some interesting remarks on this instance of mimicry.

The caterpillar of this butterfly feeds on the Madár (*Calotropis gigantea*). It is well described by Mrs. Hart in her "Notes on a Caterpillar Farm," Vol. IV., page 285, of our Journal. The pupa, which is suspended by the tail, assumes two colours, some being a delicate green, and others an equally delicate pink, as if made of wax: they have a thin black and yellow rim around the thickest part.

4. *Danais genutia*, Cramer [31].—This butterfly is almost as common as the last, and has the same habits. Its colouring is very similar, only that the veins are more broadly marked with black. The males of both this and the last have a scent-pouch in the hind-wing. It loves to congregate in large numbers, as does *D. chrysippus*. On the average this insect is larger, and, I think, handsomer than its relative. It is imitated by the female of *Elymnias undularis*.

5. *Euplæa linnæi*, Moore [56].—I have only one specimen of this species, a male from Jagdalpur. It is very much smaller than specimens from Assam, and that is all I know of it, for I have never seen it in life, and the one I have was taken by a native collector. There is some little doubt about the proper name of this species, and it is usually referred to as *E. midamus*. Mr. Moore identifies the latter with a distinct butterfly occurring in China.

6. *Euplæa core*, Cramer [61].—This rivals *Danias limniace*, *D. chrysippus*, and *D. genutia* in its general distribution. It is a deep brown, almost black in colour, with a white border to its wings. Its flight and habits are very much the same as the butterflies already described, but perhaps it loves the shade more. It is easy to capture, difficult to kill, and the male has the power of protruding two yellow bottle-brush like appendages from the end of its body. I have specimens without the spots in the cell of the wings, and I once took a specimen which had the spots in the cells of both fore and hindwing on one side but not on the other. Several butterflies resemble *E. core* in colouring, among which may be mentioned *Papilio panope* and the female of *Hypolimnas bolina*.

The caterpillar and pupa of this butterfly are also described in Mrs. Hart's paper, Vol. IV., pp. 284 and 285. The food plant is usually the Oleander (*Nerium odorum*), but last year I found four of the caterpillars feeding on the leaves of the Pipal tree (*Ficus religiosa*). I was successful in rearing all four until they reached the imago.

stage, when I set them free. This must be their real food plant, as it is indigenous and the Oleander is an introduced plant. I do not think this has been recorded before.

Sub-FAMILY—*Satyrinæ.*

7. *Mycalesis medus*, Fabricius [92].—This is the rains form of *M. runeka*, Moore [93], as Mr. de Nicéville has proved by breeding from one to the other and vice versa. *M. medus* differs from *M. runeka* in having the white streak on the underside less prominent but the ocelli much more so; in *M. runeka* they are small and obsolescent. Their colour on the upperside is a uniform dark brown, with an ocellus on the forewing in some specimens. These little butterflies are shade-lovers, and lie hidden under the trees and bushes during the day-time; they are active and restless in the morning and evening, and also when the day happens to be dark and cloudy. They possess some curious and distinctive features. The costal nervure is dilated at the base of the forewing in both sexes. This nervure does not touch the costal or upper edge of the forewing, but lies some little distance behind it. The males have tufts of hair on the hindwing. They have a skipping kind of flight when started from the shades they love; they are, however, easily caught and killed.

8. *Mycalesis blasius*, Fabricius [96].—This is the rains form of *M. perseus*, Fabricius [99], but one would think it to be a quite different butterfly. *M. blasius* has well marked ocelli and a distinct white fascia on the underside of both wings, whereas in *M. perseus* these are almost obsolete, though in some specimens of the latter there are well marked spots in the position of the ocelli which are on the wings of the former. There is a great deal more variety in the markings on the underside of the wings of *M. perseus* than there is in *M. blasius*. The apex of the forewing in *M. blasius* is a uniform dark brown, not so dark as in the last described species, but in *M. perseus* there is always a small ocellus on the forewing. The veins at the base of the forewing are swollen in both sexes and the eyes are hairy. The males have an erectile tuft of hair, and a glandular patch on the hindwing. These features are also present in the two next described species. Its habits and flight are very

similar to those of the last described species, but it is a much commoner butterfly.

9. *Mycalesis mineus*, Linnæus [97].—This is the rains form of *M. visala* [99a] and *M. indistans* [99b.] of Moore. It is larger than the last species and is not so common. To me it seems a paler insect altogether, and with a sharper angle to the forewing than has *M. perseus*. Its habits and flight are the same as the foregoing.

10. *Mycalesis malsara*, Moore [108].—This is the rains form of *M. rufis*, Moore [110]. I have taken very few specimens of these two forms; in fact, I do not think I have yet procured *M. malsara*. It is also a dark brown insect; but the underside has a redder tinge than those described before. All these insects love the shade, and the way to discover them is to beat the bushes so as to disturb them.

11. *Lethe europa*, Fabricius [135].—This is also a shade-loving insect, but is easily procured in the evening, as are all *Mycaleses* and *Melanites* at sugar. They are all also very fond of mhowa refuse after the spirit has been extracted from the flowers. Mhowa spirit is made from the flowers of the Mhowa tree, *Bassia latifolia*. The flowers are semi-transparent globular objects when fresh, and are eagerly sought after by many kinds of birds and beasts. They appear in February and March, and drop off in the early morning, so that, if you are encamped under a mhowa tree, you are awakened by a continual patter on the top of the tent as the flowers shower down. The people who collect them have to get up early, as one has to do at home when on a mushroom-gathering expedition, otherwise the cattle, jackals, bears, pigs and all the deer tribe would not leave one behind. The flowers are collected in baskets, taken home, dried, and then used up as required by the Kalars (spirit distillers). Before the spirit has been extracted the flowers do not seem to possess such an attractive power for insects, but as soon as this is done, and the refuse cast outside, various beetles and butterflies are attracted to it. I suppose the fact of there being something spirituous about it is the cause. I have found that the attractiveness of the refuse is much increased by the addition of "gur" or "jaggrī" (coarse country sugar), melted till it is like treacle, and of a little rum, or else the mhowa spirit itself; a small quantity of this put out proves an irresistible bait for *Satyrinæ* as well as various species of the

Nymphalinae. It is good to attract other insects as well, and I advise entomologists to try it. *L. europa* is a beautiful insect, with its lovely mottlings and markings, especially on the underside. It is shy and easily scared. The costal nervure is swollen at the base, and the eyes are hairy. The female is larger and more conspicuous than the male, owing to the presence of a white band across the forewing.

12. *Lethe nilghericensis*, Guérin [104].—This looks like a small edition of the former, but lacks the white band across the forewing in the female. This is replaced by three oval white spots ; its habits and structure are the same as those of *L. curona*.

13. *Ypthima philomela*, Johanssen [204].—This the rains form of *E. marshalli*. Butler [205].—All the *Ypthimæ* are small obscurely coloured brown butterflies, with ocelli on both sides of the wings, and striae on the underside. They are generally found fluttering about where there is grass, and flying in and out amongst the stems : they are feeble little things, and not difficult to capture.

14. *Ypthima ariaspa*, Moore [212].

15. *Ypthima asterope*, Klug [213].

16. *Ypthima inica*, Hewitson [214].

17. *Ypthima singala*, Felder [222].

18. *Malanitis leda*, Linnaeus [243].—This is the rains form of *M. ismene*, Cramer [249.] Both varieties are very common under bushes and in dark places. Where there is shade and moisture you sometimes come upon scores, and the bushes have only to be disturbed, when they will show themselves. They rise in so great a hurry that they knock against leaves, bushes, tree trunks, anything in fact until they rest again, and then it is a difficult matter to find them. Their colouring is a subdued yet rich brown, with a black mark on the forewing, larger in *M. ismene* than in *M. leda*. There are two or three white spots on these black marks, which former are bordered more or less continuously with ferruginous. *M. leda* has beautiful ocelli on the underside, while in *M. ismene* these can hardly be seen ; all the same, when once settled on the ground, they so closely resemble dead leaves that the sight has to be keen to detect them. *M. ismene* is altogether a larger and brighter coloured insect than *M. leda*, and the underside of the former presents the most varied patterns in

russets, browns, subdued yellows and greys. No two that I have seen are exactly alike. Some are most lovely in their rich variety of tints, while others are pale and insignificant looking. They are crepuscular in their habits, coming out in the evening and dancing about like elves, as has often been described. The singular habit they have of mounting into the air until lost to sight has some reason for it no doubt, but what that reason may be has not been discovered. They are gluttons for sweetened mhowa refuse, and can be caught with the fingers while feeding on it. They, as well as *Mycaleses* and *Lethe*, are fond of ripe fruit: a guava on the verge of rottenness has a great fascination for them. They can also be easily caught when drinking toddy, and many other butterflies share this taste. You can often find many at the foot of the palms that have been tapped, and from which the juice drops down to the ground. The shape of the wing in *M. ismene* is more falcate or sickle-shaped than in *M. leda*. They are easily caught if they can be detected on the ground.

M. leda is a smaller butterfly and not so highly coloured as *M. ismene*, and appears during the rains; while *M. ismene* comes out during the dry season. One would suppose them to be different butterflies altogether, but this is not the case; they are only seasonal forms, as Mr. de Nicéville has proved by breeding one form from eggs laid by the other form. Various other genera of the *Satyrinæ* present the same phenomenon, and as a rule those that appear during the rains are smaller, with more even wings, and the ocelli on the underside more prominent; whereas those that appear during the dry season are larger, with the outline of the wing more varied, and the ocelli obsolescent. It would appear the reason is that during the hot months the caterpillars find it difficult to procure sufficiently rich proper food, and so the result is a smaller and less highly-coloured butterfly, while in the rains the supply of food is ample, and the result is a more highly-coloured and larger butterfly. I have reared the caterpillar on the blades of green rice during the rains. It is green with a longitudinal yellow stripe and a curious forked tail. The pupa is green and suspended in a sort of slight cradle made of the blades of rice.

19 *M. bethami*, de Nicéville.—A description of both the dry and

rainy season form of this butterfly appeared in the Proceedings of the Zoological Society of London for 1887, pp. 451—453. It is a larger and more deeply-coloured butterfly than the last, but has the same habits. It has only been found about Pachmarhi, 3,500 feet, a sanitarium in the Satpura Hills, where it is fairly abundant.

SUB-FAMILY—*Elymniniæ*.

20. *Elymnias undularis*, Drury [256].—This is also a shade-loving insect with a feeble flight. The differences between the sexes is most marked. The male is a dark brown insect with blue markings on the forewing, and a reddish tinge on the hindwing, while the female imitates *Danais genutia*, being of a reddish-brown colour with black and white markings. The undersides of both sexes are the same, or very nearly so. They are fond of settling on the stems of plants and on tree trunks.

SUB-FAMILY—*Acræinæ*.

21. *Telchinia violæ*, Fabricius [298].—A small reddish-coloured butterfly with black veins to its wings, like a miniature *Danais dorippus*. It has a very tough and leathery body, and is difficult to kill but easy to capture. It is very common in many places in the Central Provinces, and seems to delight in bare, arid places, although plentiful too in moister spots.

The caterpillar is a blackish-coloured creature, and feeds on *Cucurbitaceæ*. The pupa is a very pale pink with black marks.

SUB-FAMILY—*Nymphaliniæ*.

22. *Ergolis merione*, Cramer [299].—A fairly common butterfly in many parts. The caterpillar feeds on the castor-oil plant, and the egg is covered with hairs or spines. The upperside of the imago is a tawny-brown with delicate black markings, and the underside is much darker, appearing quite black when the butterfly is flying. It settles with its wings expanded, has a slow jerky flight, and is not difficult to capture. It has a swollen costal nervure to the forewing.

23. *Ergolis ariadne*, Linnæus [301].—This is very like the last, but is smaller, and can be distinguished by its having the edges of its wing more scalloped, or “pinned,” as the ladies would say. It has also two of the veins of the hindwing on the upperside white

and shining. Its habits and manner of flight are very much the same as the last.

24. *Byblia ilithyia*, Drury [303].—This butterfly is a brighter-coloured one than the last two. I have only taken it in the Hoshangabad district, where it is fairly common. The costal nervure of the forewing in this genus is also swollen, as in *Ergolis*.

25. *Atella phaontha*, Drury [314].—A very common but beautiful little butterfly. It is wonderfully sharp and active in its movements. It looks for all the world like a fritillary with its bright rust-red wings, and black markings. Underneath, when fresh, it has pearly iridescent tints. The head and eyes look larger in proportion to its body than is the case with most other butterflies. It is fond of the sunshine, and perches in exposed situations, sallying out to fight with any other butterfly that comes along, and then returning to its old perch.

26. *Ircis iphita*, Cramer [343].—A glossy looking butterfly, in shape almost the same as the *Junonia* that follows. It is fond of shady woods, but has the habits of most of the *Junoniae* in its quick manner of flight. I have only come across it in three or four places in the Central Provinces, but where it occurs it is fairly common. It is fond of settling on the ground, and like a *melanitis* is difficult to distinguish from faded and fallen leaf.

DESCRIPTION OF A NEW FUNGUS, *AECIDIUM
ESCULENTUM*, NOV. SP. ON *ACACIA
EBURNEA*, WILLD.

By A. BARCLAY, M.B., Bengal Medical Service.

THIS *Aecidium* is one of considerable interest, not only on account of the largeness of its effect upon the host bearing it, but because it is only the second species of *Aecidium* which, so far as I am aware, is known to be eaten by human beings. The large hypertrophies caused by *Aecidium Tiliae* Schum, var. *Himalayense*, on the common nettle of the outer Himalayas (*Urtica parviflora*, Roxb.) are

eaten raw, as I have myself seen, by the poor people on account of the large amount of nutritious material stored therein by the mycelium of the fungus*; but in the present case the pure fungus itself is apparently eaten, and after some elaborate preparation, as I am informed by Mr. Wroughton, to whom I am much indebted for the kind trouble he has taken in sending me specimens. I first received a small specimen of the fungus from Dr. Cunningham, F.R.S., in August, to whom it had been sent through Mr. Cotes of the Indian Museum, Calcutta, by Mr. Wroughton. This had been gathered at Poona, but as the specimen was insufficient in many respects for any useful description I addressed Mr. Wroughton, begging him to send me other specimens, and for any general information he might be able to gather concerning it. To this he responded most generously, and all the information this paper contains, other than the more diagnostic characters of the fungus, is his.

There was at first some doubt concerning the botanical identity of the host, but Mr. Wroughton has convinced himself that it is undoubtedly *Acacia chamaecarpa*, Willd., and known to natives as Mūrmūti. In certain areas of the Poona district the fungus is most common, every tree or bush being covered with it; and it occasions such distortion and dwarfing of the host that attacked trees may be recognised from a great distance. The parasite appears to distort the stem much as the mistletoe does the stem on which it grows. As Mr. Wroughton says, "it is fortunate that *A. chamaecarpa* is of no value as a timber tree," as otherwise the presence of the parasite would undoubtedly give rise to much loss.

The specimens I received showed, even on cursory inspection, that the parasite had a generally pervading and probably perennial mycelium, and that the presence of this mycelium caused an excess of longitudinal growth in shoots, with very considerable hypertrophy or thickening. Dr. G. King, F.R.S., writes of specimens he received:— "It is curious to notice how the capitate heads of the *Acacia* become elongated when attacked by that curious fungoid growth." Anybody examining such diseased heads and not seeing the healthy

ones would at once refer them to some of the set with spicate inflorescence." The fructification of the fungus is always found at the ends of flowering shoots and not generally on the larger shoots. This consists mainly of an immense number of *æcidia* (*poridia*) dotted thickly over the younger attacked parts of the host. They are bluntly conical bodies about 1 m.m. in height and 1 m.m. in diameter.

Before proceeding to a detailed description of the fungus, I may here note that it is apparently these *Æcidia* which are eaten. They are readily scraped off the host. As I understand it, these *æcidia* having been scraped off are boiled until quite soft, and when cold are rubbed up into a mess with spices and then warmed up and eaten as a relish. Mr. Wroughton writes—"I find all the people eat it freely."

The first specimen I got through Dr. Cunningham; if collected immediately before it was sent to him, must have been gathered in July or early August, and the next specimen I got direct from Mr. Wroughton was gathered on the 11th January. Each specimen contained ripe *æcidia*; but I have no definite information as to the seasons during which the ripe *æcidia* are found, and during which they are absent. From the last specimen sent to me in alcohol it would appear that the *æcidia* are produced during the time the host puts forth new shoots; this may be once or twice a year. With these introductory remarks I proceed to a systematic description of the fungus.

The *mycelium* apparently pervades every tissue of the parts attacked, and gives rise to considerable hypertrophy of the parenchymatous cells. From this it may be concluded that the mycelium is perennial. It would, however, be interesting to know whether the parts which have once borne *æcidia* die after this, new shoots from its neighbourhood only being attacked in the next season of vegetative activity, or whether they again bear another crop of *æcidia*. It is in the highest degree probable that the former is the case. The *mycelium* itself is of the ordinary kind common to these parasites, but is characterised by the formation of innumerable *haustoria*. These are either button-like intrusions into the cell cavity (as in the *Petromycetaceæ* and *Ustilagineæ*) or simple tubes. Sometimes a

grape-like mass of button-like *acervi*, may be seen within a cell (fig. 1, Plate A).

Before the *acervi* are formed, numerous *acervula* cover the surface of attacked parts. They are usually small and superficial (fig. 2 Plate A.) being superficial to 0.5 mm. They are flat, irregular bodies, measuring from 0.5 to 2.5 mm. diam. and 3 to 10 μ in height. They repeat the usual structure and call for no special description.

The *acervi* as already noted are bluntly conical bodies, about 1 mm. in height above the host's surface, and 1 mm. in diameter. They are very deeply set, the basidial layer being about 0.075 mm. below the outer surface of the epidermis. The basidial layer is very regular and flat, and beneath it is a large mass of convoluted hyphae (fig. 3, Plate A.).

The *peridium* is very resistant and tough, but is composed of a single layer of flat angular cells (fig. 4, Plate A.). Each cell is bevelled both above and below like the edge of a chisel; the bevelled edge of the upper end overlapping the cell above *externally*. The outer surface of each cell is thickened. The thickness of the peridial layer is 20 μ .

The *acridospores* are extremely numerous within each peridium. They are given off in very long rows, the lowermost being extremely small, and indeed look like the stalks of *teleutospores* septated (fig. 3, Plate A.). Not having seen any fresh specimens I am not aware of the colour of the ripe spores. In order to obtain the following characters of the ripe spores, I first placed fragments of the host bearing ripe but unopened *acervi* which had been hardened in alcohol into a mixture of equal parts of alcohol and glycerine for 24 hours, and then in pure water for 24 hours. After such treatment the spores were found to be light brown to yellow, irregularly oval, but varying in size and shape, and teleutospores slightly spiny on the surface. They were found to be thick-walled and, with usually a small, but sometimes minute, basal (fig. 5, Plate A.) projection. These projections apparently act as the points of dehiscence of a series together (fig. 5, Plate A.). The spores measured 10 \times 16 to 19 μ . Each spore contained 2 to 4 nuclei.

Path of the disease.—The disease is characterized by the existence of a very

remarkable *Æcidium*, and I would commend a study of its life history to the members of the Bombay Natural History Society as a research very promising in yielding fruitful result. So far it will be observed no resting spore in connection with it is known. This must be sought for either on the same host, or some other widely different from it. As the parasite has apparently a perennial *mycelium* allowing it to reproduce the stage I have described, year after year, it is possible that the resting spore stage may be rare, but reasoning from analogy this other still undiscovered stage is probably abundant.

This apparently is a new species, and I have named it *Æcidium esculentum* to indicate its edibility, a rare property in this group of fungi. In a list of all the known *Uredineæ* published lately by Dr. P. Dietel* two species of *Æcidium* on species of *Acacia* are noted, one *A. inornatum*, Kalchbr., on *A. horrida*, L., and another *A. ornatale*, Kalchbr. on *A. Farnesiana*. As I have no access to descriptions of these, I cannot definitely state that the species I have just described may not be identical with one or other of these; but the probability is that it is distinct, since neither of these hosts exists in India.

Simla, 3rd February 1890.

* Verzeichniss Sämtlicher Uredineen, Leipzig, 1888.

NOTE ADDED TO DR. BARCLAY'S PAPER.

BY DR. D. PRAIN.

Teratological Effects.

The fungoid growth produces considerable general hypertrophy and some distortion of the parts involved; it causes at the same time the occurrence of certain abnormalities of structure.

The species affected, *Acacia eburnea* of Willdenow, is characterised by having its florets arranged in globose heads. These heads are borne on slender stalks that arise from the axils of developed leaves; the stalks are near their middle surrounded by a ring of small bracts. The free ends of the stalks are slightly thickened and it is to this

slightly thickened sub-globose faceted part of the stalk that the florets are attached. The individual florets do not possess special stalklets. So much of the structure of the normal inflorescence it is necessary to detail in order to make the conditions in the diseased flowers intelligible.

In the diseased flowers a ring of florets makes its appearance in the axils of the bracts near the middle of the stalk that are normally sterile. The thickened end parts of the stalk that are normally short and globose become elongated in such a manner as to transform the globular flower head into a cylindric spike on which the florets instead of being crowded together are arranged at short intervals from each other. At the same time each of the florets develops a short special stalklet, and in place of all the florets opening simultaneously as they do in the normal flower-heads, those florets in the diseased spikes that are nearest to their apices are smaller in size and later of growth than those below them. It ought to be noticed that even in fruit there is no tendency in undiseased plants to elongation of the part of the stalk to which the pods are attached, and no disposition on the part of the pods to ripen more quickly at the outside of the branch than in the centre. At the same time it has to be repeated that it is entirely owing to special elongation of this part of the stalk in diseased flowers that the flower-head becomes changed from a ball into a spike, because the interval that in normal flower-stalks exists between the barren bracts and the flower-heads themselves still continues to exist, *destitute of florets*, between the circle of florets that appears abnormally in the axils of the bracts and the basal florets of the cylindric spike. This interval which in undiseased flowers is 5—6 mm. long, measures 10—12 mm. in diseased ones. But the increase in length of this part is merely due to the general hypertrophy produced by the disease, and it is not its size but its existence at all in the diseased flower that is of interest.

Expressed in technical teratological language the conditions induced by the disease are:—Increase in the size of the parts affected by *general hypertrophy*, with some alteration of shape by *distortion* combined with conversion of florets from sessile to pedicellate by *elongation*, conversion of a capitate inflorescence into a spike by *apostasis*, change of a simultaneous and therefore at least sub-definite

inflorescence into a palpably indefinite one by *heterotaxy*, and the appearance of a new circle of florets by *proliferation* of flower-ends in the axils of the median peduncular involucra.

Explanation of figures in Plate B:—

1. Flower head with opened florets and head with florets unopened in axil of the same leaf of *Acacia eburnea*, Willd.
2. Young infructescence shewing that even in fruit there is no tendency to elongation in that part of the peduncle to which florets and subsequently pods are attached; from the same plant as preceding.
3. Diseased flower (covered with the granular papillæ indicative of the disease) shewing *distortion* of leaf; *general hypertrophy* of portion of branchlet, stipular spines and inflorescence; *proliferation* of florets in the axils of the peduncular bracts; *apostasis*, and at the same time *heterotaxy*, in the normally floret-bearing portion of peduncle; with pedicellation of individual florets that are normally sessile.

NOTES ON OATES'S BIRDS OF INDIA.

THE appearance of Mr. Oates's volume on the birds which forms part of the "Fauna of British India," edited by Mr. W. T. Blanford, and published under the auspices of the Indian Government, is an event of great importance to ornithologists, and for the benefit of our Indian readers we have strung together a few notes which may be of service to the numerous students of bird-life in India. Mr. Eugene Oates is a Civil Engineer who has seen long service in the East, one of those officers whose work it has been to open up British Burma to the influences of civilisation. Like many other intelligent officials, Mr. Oates has found time during the intervals of road and canal-making, bridge-building, &c., to study ornithology, and he was one of that famous band of contributors who rallied round Mr. Hume and his ornithological journal—"Stray Feathers." When on furlough in England in 1881—1883, he wrote his "Hand-book to the Birds of British Burma—" a book which at once placed Mr. Oates in the front rank of British naturalists. That he is possessed of the true spirit of self-sacrifice in the cause of science has been shown by his willingness to come to England on half pay, in order to write the ornithological portion of the "Fauna of British India." We hope that ample leave of absence will be granted to him to finish with his own hands the task which he has commenced with so much credit. Mr. Oates has

undoubtedly been much hampered by the mode of publication which the "Fauna of British India" has taken, for the compressed form in which the work is issued gives the author no scope for detail, and the ornithological volumes will be but the stepping-stones to a more elaborate work on the Avi-fauna of India, which, it is to be hoped, Mr. Oates will have time to publish. When we think of what a real faunistic work is, much, for instance, as Godman's and Salvin's "Biologia Centrali Americana," or Granddidier's "Histoire Naturelle de Madagascar," it seems a pity that the more modest title of "Hand-book" was not retained for the series of volumes on the Natural History of British India, over which Mr. W. T. Blanford presides. Granting, however, the restricted space which was at Mr. Oates's disposal, his work of condensation could not have been more ably performed, and he stands as a master of the art along with Mr. Salvin, Professor Newton, and Mr. Howard Saunders, who are the greatest ornithological experts in the compression of facts.

With the publication of the present volume will probably commence the fourth era in the history of Indian ornithology. The first we should call the "Blythian Era" (1846—1860). To the previous labours of Jerdon (1840—1844) came the supplementary labours of Blyth, whose residence in Calcutta was marked by that wonderful series of papers on Indian Biology, which gathered up the threads of information from all corners of the British Asian Empire, but which were never published by the author in a connected form. Then came the "Jerdonian Era," from 1860—1872, when Jerdon reduced to order all the scattered details of Indian ornithology, and paved the way with his "Birds of India" for the "Humeian Era" (1870—1882). Around the name of Mr. A. O. Hume will cluster for ever the memories of some of the best ornithologists which England has ever produced, and the work which was done under his leadership was truly remarkable. The collection which he personally made, the enthusiasm which he created in his followers, the generalship with which he directed the studies of his coadjutors, added to the untiring energy which he himself infused into every detail of his ornithological scheme, have all combined to render the "Humeian Era" remarkable for its accomplishments in the history of ornithology. The purloining of his MSS. by a rascally servant, involving the annihilation of the results of years of patient labour, proved such a great disappointment for Mr. Hume, that he gave his collection, one of the wonders of the scientific world, to the British Museum; and it is on this collection that the labours of Mr. Oates have mainly been based. The Tweeddale collection of birds, and the unequalled library of ornithological works, presented by Major Wardlaw Ramsay to the British nation, have, added to the Hume collection, constituted all the material that was necessary for an author in the production of his book; and the facilities rendered by the authorities of the Natural History Museum have enabled Mr. Oates to write his work with such completeness that it will undoubtedly be considered as one of the most important of contributions to ornithology of the present day, and with the year 1890 we may look forward to the commencement of the "Oatesian Era."

We hope that ornithologists will make, if necessary, such a strong representation to the Government of India, that there may be no question about the grant of special leave to Mr. Oates to enable him to finish his work, for fear that the conclusion of it should fall into less capable hands.

Now for the work itself. The first volume consists of the "Preface," by the editor (pp. 1—10), followed by a diagram of the contour of a bird, which will be useful to beginners in assisting them to describe a specimen. There are one or two slips, which may as well be pointed out in this description for correction in a subsequent edition. The "nape" is by no means *the same* as the "occiput;" witness such names as *Parus nuchalis* (p. 49) and *Ixulus occipitalis* (p. 217). The space allowed for the "abdomen" is too large, seeing that the "breast" is generally supposed to be the portion of the body overlying the sternum, and the "fore-neck" and "chest" are entirely omitted in Mr. Oates's vocabulary, his "breast" being occupied by what we ourselves call the "lower throat," "fore-neck," and "chest." Similarly, the portion which he calls the "back" we should divide into the "mantle," or "interscapular region," "upper" and "lower" back. Mr. Oates fully recognises these divisions in his descriptions (Cf. *Dendrocitta frontalis*, p. 33, &c.) We also regret to see that he once more introduces the term "tertiaries" instead of "innermost secondaries." The former term implies that these quills spring from a separate bone of the wing.

In his primary classification, Mr. Oates has adopted the main divisions recently proposed by Mr. Seebold from a revision which the latter gentleman has been making of the general characters of the class *Aves*. For the last two years Mr. Seebold has been revising and collating all the work of recent ornithologists, and has by the most careful study, discovered many new points which bear on the classification of birds; so that of all the schemes for the arrangement of the higher orders of birds, this new one of Mr. Seebold's seems to us to be most worthy of general acceptance. Mr. Oates briefly explains the leading characters of the Passeres (with which alone this volume deals), and illustrates the leading features of the order with a capital selection of wood-cuts, the skull of the Raven being figured to show the *Ægithognathous* palate. This figure is far more characteristic than the one which illustrates Professor Huxley's determination of the *Ægithognathous* palate in the "Proceedings" for 1867. Then on pp. 8, 9, Mr. Oates gives a "Scheme"—*i.e.*, a "Key"—for the determination of the Families of Passerine Birds, with which we could at first find no fault, as it was evidently an artificial or student's "Key," until we turned over the pages of the book and found that the author had conscientiously followed the minor details of the "Key," and had adopted the order into which the families had dropped under the artificial arrangement which he had elaborated for their identification. The result of these characterisations is that the Titmice disappear as a family, *Paridae* altogether, being absorbed in the *Corvidæ*; the *Timeliidæ*, the "waste-paper basket" (test Tristram) of ornithologist, likewise vanish, and are replaced by the *Crateropodidae*, which is, as a friend of ours would say, the same monkey on

another bough ; the *Dicuridae* appear as a family between the *Sittidae* and the *Certhiinae* ; the *Regulidae* are a full-blown family, and lead from the *Sylviidae* to the *Laniidae* and *Oriolidae*, which in turn approach the *Sturnidae* by means of a new family, the *Eulabetidae*. This arrangement of the families is a blemish on the book, and the use of an editor should have here been apparent, if he had suggested to the author that this arrangement was certain to be accepted *literally*, and that a footnote of explanation that the "Key" was an artificial, and not a natural one, would have saved the necessity of the above remarks. We know from our own experience that in the making of "Keys," where the species or genera are numerous, it is often impossible to fit them all in what seems a natural order, and certain "keys" must of necessity be more or less artificial. In such cases we have always stated that fact, and in the arrangement of the genera or species have followed what we conceived to be the more natural arrangement Cf. also Coues's Key to North American Birds (p. 230).

The chief character for the division of the ten-primaried Passeres on which Mr. Oates relies is to be met with in the plumage of the young birds. Mr. Seebom was the first ornithologist to recognise this as a fundamental character, and it enabled him to characterise his Thrushes and Warblers in a philosophical and satisfactory manner. Mr. Oates is the first ornithologist who has carried it out for the bulk of the Passeres, and he finds that five types of nestling plumages exist in these birds.

In the *first* the nestling resembles the adult female.

In the *second* the nestling resembles the adult female, but is more brightly coloured, and generally suffused with yellow

In the *third* the nestling is barred.

In the *fourth* it is streaked.

In the *fifth* it is mottled or squamated.

That much of the natural affinity of birds may be elucidated by the colouring of the young we do not deny, and we look upon the nestling plumage as an indication of the ancestral colouring of the species, but whether it is capable of being reckoned as a primary character for the sub-division of the Passeres we very much doubt.

We would not have the reader suppose that the characters given by Mr. Oates in his "scheme" of Passeres are the only ones on which he relies for the characterisations of these birds. On the contrary, each family is introduced with a carefully detailed account of its characteristics and full explanations are given. We will give a short sketch of the volume with its principal features. The corvidæ have three sub-families—*Corvinæ*, or Crows; *Parinae*, Titmice; and *Paradoxornithinae*, or Crow-tits. Mr. Oates says that the affinities of the Tits with the Crows "are recognised by all writers on ornithology." The present writer at least begs to dissent from this arrangement, for he can find little in common with such a bird as the moss-nest building long-tailed Titmouse and any species of ambulatorial, carnivorous Crow. According to Mr. Oates the Titmice must

be divorced, *toto cælo*, from the Shrikes, but then how about such forms as *Folconulus*. The difficulty of finding appropriate English names for exotic birds is well known to us, but Mr. Oates can improve on his trivial nomenclature in his second edition, *e.g.*, *Lophophanes* means "crested" Titmouse; but we find that *L. aemodus* is a "cole" tit and *L. rufinuchalis* is a "black" tit. Mr. Oates's great family *Crateropodidæ*, is virtually the family *Timeliidæ* of our "Catalogue of Birds," and we greatly prefer the latter name, for the typical genus *Crateropus* is an African form, feebly represented in Asia, and its adoption leaves a wrong impression. Six sub-families make up the *Crateropodidæ*, and the characters for their separation are most ingeniously contrasted. In the next edition we would advise Mr. Oates to bring them to the rank of "families," and the arrangement will be at once simplified. The first sub-family of the *Crateropodidæ* are the *Crateropodinæ*, or Laughing Thrushes; and here we notice that Mr. Oates has changed the position of some of the species from that in which we placed them in the "Catalogue of Birds;" but in all such instances we expect to find that he is right, for he has examined the characters of all the species with more detailed application than we were able to give in the "Catalogue." The *Crateropodinæ* are a natural sub-family, and we do not find much fault with his *Timeliinæ*. *Myiophonus* seems to us to be too meruline to be placed so far from the true Thrushes; but Mr. Oates makes out a good case for this and his other *Brachypteryginæ*. The *Sibiinæ* are not nearly so natural a division, in our opinion, and may possibly have to be annihilated, *Lioptila* and its allies going with the *Garrulaces*, and *Staphidia*, *Iora*, &c., following *Stachyris*, or becoming merged in the *Liotrichinæ*. *Zosterops* is surely out of place among the *Crateropodidæ*, and we still retain our conviction that its affinities are Meliphagine as may be seen from the description of its tongue (p. 213). Among the *Liotrichinæ* (p. 220) are some incongruous genera, such as *Pteruthius*, *Ægithinæ*, *Chloropsis*, *Irena*, *Leptopæcile*, *Psaroglossa*, and *Hypocolius*. If *Hemipus*, *Pericrocotus*, &c., are Laniine (pp. 456, 457), we see no reason why *Pteruthius* and *Hypocolius* should not have been included.

The Bulbuls or *Brachypteryginæ* are a satisfactory and natural sub-family, and we suspect that Mr. Oates's allocation of some of the species is more correct than that of our sixth volume of the "Catalogue." We notice, however, that he is inclined to reject Hodgsonian names, when they happen to have no description; but hitherto the titles published by Hodgson in Gray's "Zoological Miscellany," founded avowedly on his unpublished drawings in the British Museum, have been allowed to stand, and it is a pity that this antagonism to the names which we had established in the "Catalogue of Birds" should have arisen, *e.g.*, *Pellorneum mandellii* (Blanf.) for *P. Nipalense* (Hodgs.,) p. 140, *Pycomotus bengalensis* (Blyth) for *P. pygæus*. (Hodgs.,) p. 271. Although we shall adopt most of Mr. Oates's amendments, we do not feel bound to follow him in this rigid adherence to nomenclatural law. Of course, he will be bound in strict consistency to reject Boddaert's names, and here again we should not follow him.

Likewise we hope that he has some stronger reason than the fact that *Otocompsa emeria* is by Linnaeus "distinctly stated have come from Bengal," for his upsetting of the nomenclature of *O. emeria* and *O. jacosa*. The locality "Bengal" had a wide significance with writers of a hundred years ago.

The author's review of the *Dicruridae* is very satisfactory (pp. 310, 311), but the family is strangely out of place between the *Sittidae* and *Certhiidae*. In his family *Sylviidae*, Mr. Oates unites all the Grass-warblers (*Cisticolæ*), with the true Warblers, and the whole of this portion of the work is very scientifically treated, though again we do not like the order of the genera. *Luscinioidea* with its one species, *L. melanopogon*, is placed between the Tailor-birds or (*Orthotomus*) and the Fantail-warblers (*Cisticolæ*), and *Acanthoptila* finds a new home near *Schemnicola* and *Chetornis*. This is apparently a good discovery of Mr. Oates, as is undoubtedly the separation of *Abroensis* from *Cryptolopha*, by reason of the hitherto unknown difference in the number of the tail-feathers. *Acanthopneuste* is separated from *Phylloscopus*, and to the latter are restored many of the species incongruously placed in *Luscinioidea* by Mr. Seebold in the fifth volume of the "Catalogue of Birds." Although we have hitherto associated the Cuckoo-shrikes with the Flycatchers, we do not object to follow Mr. Oates in placing them among the Shrikes, and *Hemipus* and *Tephrodornis* may also go into the *Laniidae*. The family *Prionopidae*, which in the third volume of the "Catalogue" we adopted from Sundevall, was never one which we felt much enthusiasm about, and it was somewhat of a "waste-paper basket," but Mr. Oates is the first ornithologist who has attempted to allocate the Prinopine genera in other families in anything like a satisfactory way.

Although we are compelled to differ from Mr. Oates on certain questions, these are really of very minor importance, and in no wise detract from our admiration of the way in which he has performed his task. It is mainly because the work is so good that we have analysed it so minutely, in order to discuss the points of difference between Mr. Oates and ourselves; and we give below a list of the modifications which he has introduced into the first volume of the "Birds of India," in the hope that they may be of service to ornithologists. We may add that the whole volume is profusely illustrated with wood-cuts, which are excellent examples of Mr. Peter Smith's work, and they are a great assistance in deciphering the minor points of structure which Mr. Oates has discovered in his classification of the Passeres.

FAM. CORVIDÆ.

SUB-FAMILY CORVINÆ.

Corvus corax.—Difference between Ravens from Sikkim and from the Punjab.

Neck-hackles figured. E. W. Oates, Faun. Brit. Ind. Birds, p. 14.

Corvus sharpii, sp. n., is the Siberian form of Hooded-Crow which winters in N.W. India; id. i.c., p. 20.

Corvus collaris, the Jackdaw of Cashmere, not distinct from *C. monedula* : id., t.e., p. 22.

Urocissa magnirostris (Blyth).—*U. occipitalis* (Blyth), and *U. cucullata* (Gould) = *U. flavirostris* (Blyth). id., t.e., p. 27.

Endrocitta assimilis (Hume)=*D. himalayensis* (Blyth), id., t. e., p. 32.

SUB-FAM. PARINÆ.

Lophophanes humii (Brooks)=*L. aemodius* : id., t. e., p. 58.

SUB-FAM. PARADOXORNITHINÆ.

Scæorhynchus, gen. n. Type, *S. ruficeps* (Blyth) : id., t. e., p. 68.

Paradoxornis gularis (Horsf.) is a second species of *Scæorhynchus* : id., t. e., p. 69.

Cleuasicus—*Suthora* id., t. e., pp. 66, 67.

FAM. CRATERPODIDÆ.

SUB-FAM. CRATEROPODINÆ.

Garrulax galbanus (G. A.) is a *Dryonastes* : id., t. e., p. 76.

Dryonastes strepitans (Blyth) is a *Garrulax* : id., t. e., p. 83.

Trochalopterum cineraceum (G. A.), *T. rufogulare* (Gould), and *T. austeni* (Jerd.) are all referable to *Ianthocincla* : id., t. e., pp. 85-87.

Trochalopterum ruficapillum (Blyth) is the true *T. chrysopterum* (Gould), from the Khasi Hills, and *T. chrysopterum*, auct. (nec. Gould) is renamed *T. nigri-mentum* (Oates, ex Hodgson MSS.) : id., t.e., pp. 90, 91.

Trochalopterum simile reinstated as a distinct species from *T. variegatum* : id. t.e., p. 96.

Grammatoptila austeni, sp. n. Daphla and E. Naga Hills : id., t.e., p. 104.

Argya hyperythra (Sharpe)=*A. subrufa* (Jerd.) : id., t.e., p. 109.

Pyctorhis longirostris (Moore) is an *Argya* : id., t.e., p. 109.

Layardia rufescens (Blyth) and *Garrulax cinereifrons* (Blyth) must be placed in *Crateropus* : id., t.e., p. 114.

Pomatorhinus pinwilli (Sharpe)=*P. schisticeps* : id., t.e., p. 116. *P. obscurus* (Hume), distinct from *P. Horsfieldii*, id., t.e., p. 120. *P. imberbis* (Salvad.) is the form of *P. erythrogenys* from Karen-Nee and Tenasserim : id., t. e.. p. 125, note. *P. inglesi* (Hume)=*P. hypoleucus*, juv. : id., t.e., p. 126.

SUB-FAM. TIMELIINSE.

Pellorneum mandellii, nom. emend. pro. *P. nipalense* (Hodgson) (*nom nudum*) : id., t.e., p. 140.

P. intermedium (Sharpe)=*P. minus* (Hume). Types compared : id., t.e., p. 141.

Scotocichla (Sharpe)=*Pellorneum* : id., t.e.. p. 143.

Drymocataphus ignotus (Hume), apud Sharpe, is a true *Pellorneum* : id., t. e., p. 144.

Turdinus magnirostris (Moore), apud Sharpe is a *Mallacopterum* : id., t.e., p. 151.

Thingorhina, gen. n. Type *Turdinus guttatus* : (Blyth), id., t.e.. p. 155.

Actinodura oglhi, g. a., is a *Thingorhina*; id., t.e., p. 156.

Rhopocichla, gen. n. Type *R. artriceps* (Jerd.) with *R. nigrifrons* (Blyth) and *R. bourdillonii* (Hume): id., t.e., pp. 159—161.

Stachyridopsis lays spotted eggs, and *Stachyris* lays white eggs. *S. nigriceps* (Blyth), *S. chrysœa* (Blyth), and *S. assimilis* (Wald.) belong to *Stachyris* and *S. ruficeps* (Blyth), *S. rufifrons* (Hume), *S. pyrrhops* (Blyth) belong to *Stachyridopsis*: id., t.e., pp. 162—166.

Schæniparus distinct from *Minla* which is placed in the *Liotrichinæ*. It contains three species: *S. dubius* (Hume), *S. mandellii* (G. A.), and *S. rufigularis* (Mand.): id., t.e., pp. 168—171.

Sittiparus, gen. n. Type *S. cinereus* (Blyth) and *S. castaneiceps* (Hodgs.): id., t.e., pp. 171, 172.

Lioparus, gen. n. Type *L. chryæsus* (Hodgs.): id., t.e., p. 174.

SUB-FAMILY BRACHYPTERYGINÆ.

Callene albiventris (Blanf.) and *C. rufiventris* (Jerd.) must be placed in *Brachypteryx*: id., t.e., p. 185.

Brachypteryx hyperythrus (Jerd. and Bl.), *B. crissalis* (Blyth) and *B. nipalensis* (Moore), must be placed in *Drymochares*: id., pp. 187—189.

SUB-FAM. SIBIINÆ.

Malacias=*Lioptila*: id., t.e., p. 196. The species are *L. capistrata* (Vig.), *L. gracilis* (McClell.), *L. melanoleuca* (Tick.), *L. castanoptera* (Salvad.), *L. annectens* (Blyth), *L. davisoni* (Hume), and *L. pulchella* (G. A.).

L. davisoni (Hume) is not the same as *L. saturata* (Wald.), which=*L. annectens* (Blyth): id., t.e., pp. 199—200.

Ixops (Hodgson), distinct from *Actinodura*, id., t.e., p. 203.

Actinodura daplaensis and *A. waldeni* belong to *Ixops*: id., t.e., p. 204.

SUB-FAM. LIOTRICHINÆ.

Melanochlora sultanea not a Titmouse: id., t.e., p. 241.

Hilarocichla, gen. n. Type, *Pteruthius rufiventer* (Blyth): id., t.e., p. 243.

Leptopæcile not a Titmouse or a Warbler: id., t.e., p. 246.

SUB-FAM. BRACHYPODINÆ.

Criniger burmanicus, sp. n.: id., t.e., p. 286.

Alophoixus, gen. n. Type, *Tenus phœocephalus* (Horsf.): id., t.e., p. 259.

Hypsipetes maclellandii (Horsf.) and *H. tickelli* (Blyth) belong to *Hemixenus*: id., t.e., p. 265.

Molpastes (Hume), reinstated as a genus, id., t.e., p. 267.

M. pygæus (auct. ex Hodgs.)—*M. bengalensis* (Blyth): id., t.e., p. 271.

Otocompsa leucotis (Gould) is a *Molpastes*: id., t.e., p. 273.

Molpastes humii sp. n., id., t.e., p. 274.

Xanthicus, gen. n. Type, *X. floresiensis* (Blyth): id., t.e., p. 275.

Otocompsa jocosa (L.), apud Sharpe = *O. emeria* (L.), and *O. emeria* (L.), apud Sharpe = *O. fuscicaudata* (Gould) : id., t. c., p. 277.

Hemixus malaccensis (Blyth), apud Sharpe; *Xenocichla icterica* (Strickl.), apud Sharpe : and *Hypsipetes virescens* (Blyth), apud Sharpe, are all referable to *Iole* : id., t. c., pp. 283—285.

Rubigula = *Pyznonotus* : id., t. c., p. 286.

Pycnonotus pusillus (Salvad.), restored as the name for *P. salvadorii* (Sharpe) : id., t. c., p. 293.

FAM. DICRURIDÆ.

Buchanga, not distinct from *Dicrurus*, id., t. c., p. 310.

Dicrurus nigrescens, sp. n., Tenasserim, id., t. c., p. 315.

Dissemurus, gen. n., Type, *D. lophorhinus*, id., t. c., p. 322.

FAM. TROGLODYTIDÆ.

Elachura, gen. n. Type, *Troglodytes punctatus* (Blyth, nec. Brehm), *T. formosus* (Wald.) : id., t. c., p. 339.

FAM. SYLVIIDÆ.

Cisticola erythrocephala (Blyth), *C. tytleri* (Jerd.), and *C. volitans* (Swinh.) are distinct and not identical with *C. exilis*, V. and H. : id., t. c., pp. 371—373.

C. granilis (Frankl.), *C. rufescens* (Blyth), and *C. cinereicapilla* (Moore) belong to *Franklinia* : id., t. c., pp. 376—379.

Acanthopneuste, distinct from *Phylloscopus* : id., t. c., p. 411.

A. davisoni, sp. n. : id., t. c., p. 420.

Abromis has ten tail feathers, and is distinct from *Cryptolopha*, which has twelve : id., t. c., p. 428.

Cryptolopha tephrocephala (Anderson) distinct from *C. affinis* : id., t. c., p. 423.

FAM. LANIIDÆ.

Pericrocotus elegans (McClell.) (type examined) is *P. speciosus* (Lath.), so that *P. elegans* (Sharpe et auct. dee. McClell.) must stand as *P. fraterculus* (Swinhoe) : id., t. c., p. 479.

Lalage = *Campophaga* : id., t. c., p. 491.

FAM. STURNIDÆ.

Sturnius humii vice *S. indicus* (Hodg.) (*nomen nudum*) : id., t. c., p. 520.

Agropsar, gen. n. Type, *Sturnia sturina* (Pall.) : id., t. c., p. 530.

Sturnia burmanica (Jerd.) and *Acridotheres leucocephalus* (Gigl. and Salvad.) referred to *Graculapica* : id., t. c., p. 536.

R. BOWDLER SHARPE.

(*The Field*, March 15, 1890.)

SOME NEW BOOKS OF INDIAN ZOOLOGY.*

In the early years of Her present Majesty's reign, the few naturalists of India worked almost "on their own hook"; at any rate, with little assistance. A handful of Madras doctors and one Madras Civilian, a Bombay doctor or two, and scarce any one else in Bombay. A little group centring at the Bengal Asiatic Society, with Blyth and Hodgson as leaders, were preparing the way. Except Blyth himself, and the early martyr Helfer, scarcely one was what we now call a professional naturalist, devoted to India, though some birds of passage of that feather had come and gone.

Meanwhile the flood of the Victorian age was setting in strong at home. The late Prince Consort, after his fashion, was aiding and encouraging every science and art; and new names were already beginning to be known in scientific circles that have since become known to the world.

The outer circles of the wave were felt even in the somewhat Philistine Secretariat of India, and Lord Canning's Government, casting around for a competent man, directed Surgeon-Major T. C. Jerdon, of the Madras Army, to compile a set of manuals of the mammals, birds, fishes, and reptiles of India.

No better man could have been found in the Services. Probably the only other possible man was the lamented Blyth, Jerdon's friend, and perhaps his superior as a naturalist, but probably not his equal for the matter in hand. At any rate, the acknowledgment of Jerdon himself, couched in most generous terms, leaves little room for doubt that all that could be done for the work by Blyth was done by him.

* "THE FAUNA OF BRITISH INDIA, INCLUDING CEYLON AND BURMA"

Published under the authority of the Secretary of State for India in Council.

Edited by W. T. BLANFORD, F.R.S. London: Taylor and Francis. Calcutta: Thacker and Spink. Bombay: Thacker & Co.

"MAMMALIA," Vol. I., PART I., by W. T. BLANFORD, &c. "FISHES."

2 Vols. (complete), by FRANCIS DAY, C.I.E., LL.D., Deputy Surgeon-General. "BIRDS," Vol. I., EUGENE W. OATES.

"THE AVIFAUNA OF BRITISH INDIA AND ITS DEPENDENCIES." By

JAMES A. MURRAY, Member of the Bombay N. H. Society, &c. London: Trübner & Co. Bombay: Education Society's Press.

The dates of Lord Canning's orders on the subject are not available to the public, but probably they were issued in the early days of his Viceroyalty, and the starting of the work was delayed by the outburst of the Mutiny. Jerdon served in it with his corps, and was one of those whose courage and endurance left India to future naturalists. In 1862 he dedicated the first part of the "Birds of India" to Lord Elgin, and the latter was scarcely cold in his grave, when the volume on "Mammals" was published. The writer evidently hoped to live to publish those on Reptiles and Fishes, but the hope was not fulfilled. It may be that some day some one may publish a memoir of his career. There is a certain note of kindness and modesty in his writings, which leads the reader to think that he must have been a most charming comrade as much at the mess table as in the jungles he explored so well. Both the "Birds" and the "Mammals," too, are books of high literary merit in their way: pure English expression, untainted by slang, pedantry, or jealousy.

Jerdon's work was resumed when the Ray Society published Dr. Günther's fine monograph on the "Reptiles of India," and was completed when his friend Dr. Day completed *his* great work on the "Fishes of India." Both of these were works on a far grander scale than had been allowed to Jerdon. The former was soon followed by Dr. Nicholson's (another Madras doctor) "Indian Snakes," and the latter was published almost simultaneously with the then Lieutenant Beavan's "Freshwater Fishes of India."

Mr. Murray was already at work in Sind and Mr. Oates in Burma before Dr. Day's *magnum opus* was published. Mr. Hume was editing *Stray Feathers*, and the Indian naturalist had a chance of a library at last, for the study of the vertebrata.

But the years of the Crimean and Persian wars, the Mutiny and those that followed them, were not years suitable for the extension of science amongst amateurs. The best men of the Services were fully occupied in the giving and taking of hard knocks, and, when that was over, in picking up the pieces.

The great American war turned many vigorous minds exclusively to cotton and stock-jobbing, and the lamp that burned from 54 to 64 got but little new oil in that decade.

The doctors and the Geological Survey men were they who

chiefly kept it alight when Blyth and Jerdon were gone. The culture of the early competition-wallahs was chiefly literary, and that of their military contemporaries was, when not literary, mostly mathematical or artistic. Nothing could better show the state of things than the fact that Jerdon's volume on Mammals was only *reprinted* (not edited) in 1874, the "Birds," I believe, not until 1880 or thereabouts.

The latter was so scarce a book that each of three volumes that I possess is to me the relic of a separate friend that got it for me—one dead, one gone, and one serving afar off.

But the ebb was over, and the flood had set in again; those who were really capable of becoming centres of inquiry were every day finding more and more who would contribute chance facts or specimens. The *Bombay Gazetteer* office was routing out everybody who knew anything about anything, and lent a great impulse to every kind of inquiry by its studious and honourable acknowledgement of every contribution of fact.

The *Indian Antiquary* was waking up other branches of investigation as long ago as 1872, and it could not do so without the echo reaching Natural History.

For, as any one familiar with Anglo-Indian culture cannot help remarking, in every science the leading men must necessarily be those who devote themselves chiefly to it; but the second rank, the observers and collectors of specimens, are generally men of somewhat varied tastes.

Life in the Mofussil is generally deadly dull. Shikar is not everywhere. A chance of making love is a rare luxury and the "flowing bowl" apt to be a snare.

Music, except for the favoured few who can play the fiddle, is not portable. (I decline to count the banjo.) So the man who has the best chance of a tolerable existence is he who can get enjoyment equally out of a bird, a fish, a rat, a stone in its natural state, or the same in that of some crumbling temple, a scrubby bush (any fool can appreciate a big tree), or, in short, *Ovis tes scibilis*. This sort of versatility does not make scientific masters, but it does make men who can bear a hand, and some men possessed of it have been very valuable to more than one science. I need only quote such names as

those of Brian Hodgson, Sir Walter Elliot, and that 19th century Elizabethan, the late Colonel Yule.

On men of this sort of culture the last few years have acted with great force, and this is the state of things that has, for instance, filled half a big house with the Anthropological and our own Society, neither of them in receipt of any extraneous aid, nor impelled by any power but the free will of their members.

A society in this condition has naturally been clamorous for books of reference, and a good deal of public money has been spent in answering the demand. It is the fashion to say that Government is stingy, but the truth is that Government has done a good deal in this way. No province of any nation need be ashamed of the Bombay Archaeological Survey and its splendid quartos, nor of the *Bombay Gazetteer*, a new edition of which is already under discussion.

A somewhat meagre Geological manual and a very good Meteorological one have been issued within the decade, and what we wanted most was a set of tolerably cheap zoological manuals for all India.

The Secretary of State has undertaken the supply, and entrusted Mr. W. Blanford, late of the Geological Survey of India, with the superintendence of it. It is not likely that he could have chosen a better man for his work.

An early scientific training, natural aptitude, and twenty years of the East, are qualifications that may well bespeak confidence and respect for the Editor of the *Fauna of British India*; and if, in examining his work, we find reason to complain of parts of it, he may well ask us if we could have done better.

It is, however, the duty of a critic to speak his mind without fear or favour, and so we hope to do in reviewing the works noted at the head of this article.

Dr. Day's two volumes on "Fishes" are the only part of the "Fauna" yet complete, and possess a melancholy interest as the last work on earth of their author. He held on, under considerable difficulties, until he had already been warned to "make his soul" for the approaching end, and the present writer thinks that it wanted little making. It is merely a cheap and portable abridgment of his great

work, with a few additions to bring it up to date, and the fine engraving left out for economy's sake. It is, however, worth noting that in this last work Dr. Day has finally abandoned the old classification in which the sharks, saw-fishes, and skates were taken as the lowest fishes, and has put them at the top of his list.

The ichthyology of India gave no opportunity for discussing the claims of *Lepidosiren* and *Ceratodus* to this position, because we have not yet found either here. And, as Dr. Day wrote within narrow limits of space, and the Editor admits having squeezed his literary bones in their *coffin*, we shall not soon know his opinion on this point.

It had been an act of grace in Mr. Blanford, in such a case, to have refrained from what he calls "additional compression." There are some of us would rather he had put the screw on the Mammals. He has no excuse for referring us for the "limits of the *arca*" to the half volume of Mammals already published. For he had three-quarters of a page to give them in, which is now blank; and many people will buy a whole book of fishes who will not *buy* a quarter book of mammals.

The references to "Mr. F. Day, C. I. E., Deputy Surgeon-General," are in a rather stupid style of official pedantry. "Dr. Day" died "Dr. Day" not merely by courteous custom, but by the law of his country, and so he was rightly addressed and quoted, in speech and in black and white. *Requiescat in pace.* It will be long till the Fishes of India look upon his like again;—*and vice-versâ.*

The man who has these two volumes, Lieut. Beavan's "Fresh Water Fishes of India" and Mr. Thomas's "Rod in India"—has the Indian fisherman's library. If he wants more, he can look out for the second (Dr. Day's own) edition of his great work, and these four books, judiciously interleaved and annotated, will last him his lifetime.

These two volumes on Fishes have been first noticed of the "Fauna," because they are the only complete part of it yet issued.

The Editor himself opened the ball with a paper bound "half volume" on the Mammals. This is nearly two years old now, and as yet there is no sign of the second half volume. We wish people would call volumes volumes, and not "half volumes."

The instalment, however, has conspicuous merits. To begin with

it is the only book of the lot, as yet, that has its price plainly marked on it ; secondly, it is the only one which has not been subjected to what the Editor euphemistically calls " compression." We should prefer to call it *desiccation*. In a case of this sort, it is better to be the compressor than the compressed. At any rate, we have here a complete list of the Mammals of India, so far as the half volume and the author go, and probably no man alive could have done it better.

The style, compared to that of the early Victorians, is undignified and meagre, but it is *alive* in its way, and we know now what a most competent authority—probably *the* most competent—thinks about so many of our beasts as he has yet found time to give us his mind about. The book is really a book, and not a catalogue of flat skins ; and the sooner we have the rest the better. We shall then lay our old well-pencilled volumes of Jerdon's "Mammals of India" aside (with a sigh no doubt), but aside for all that.

Perhaps the point most interesting to sportsmen in this half volume is that Mr. Blanford finally disposes of the distinction between "leopard" and "panther." Many—the present writer amongst them—had long clung to the idea that these were two, but it seems impossible not to admit the force of Mr. Blanford's arguments for their identity ; and our own collection of skulls bears the same way. The very puzzling Indian Otters are here for the first time reduced to intelligible order, and the mysterious "Mumh" of Beluchistan becomes a commonplace black bear, which we are to call *Ursus torquatus* instead of *Thibetanus* as hitherto, because although found on the Himalayas and even in China, it does not appear to have been recorded from Thibet.

Information about the Hedgehogs is evidently much wanted ; Mr. Blanford seems a little at sea about their distribution, and is clearly unaware that they are common in the north of British Gujarat. There seem to be two species, probably *Erinaceus pictus* and *E. Jerdonia*.

One curious correction our own records enable us to make,—for Mr. Sterndale has here recorded that the White-browed Gibbon does not " drink with its lips putting its head down to the water, but dips its hand in the water and then licks the back of it." This is

probably the action recorded of the White-handed Gibbon by Mr. Blanford as "scooping up water."

Few of the illustrations are original, and none of any artistic merit, but the anatomical drawings have considerable scientific value apart from these considerations.

On the whole, as observed above, if we ever get the rest of this book, it is going to be "The Mammals of India."

As regards the Reptiles and Batrachia, we are promised a volume or so from Mr. Boulenger of the British Museum, a most competent authority, except for the trifle that he is not known to have ever been in India for anything worth calling a residence. It will be time enough to criticize Mr. Boulenger's work when we see it; and he, if any man, deserves kindly criticism, for his aid has been unsparingly given to all Indian Naturalists who have sought it.

The next thing to consider is the Ornithology.

Of this we have as yet a single volume devoted to the Passerine Birds, and fathered by Mr. Eugene Oates, whose name is already favourably known to this Society. It is to be regretted that the Editor (not Mr. Oates) has thought fit to preface it with the remark that "the classification adopted by Jerdon was obsolete even when he wrote," which is in very bad taste and inaccurate.

The classification in question is hardly obsolete yet, and several observations of Jerdon's show that he adopted it, as others since him have done, for the sake of his readers. The result has justified him. His work is at this day an Indian Classic. Let us see what is offered to us to supersede it.

Any modern Indian Ornithology must contain nearly 50 per cent. more species than Jerdon's work, chiefly, as Mr. Blanford is careful to observe, because the modern area is nearly double of Jerdon's, and includes countries very different from those to which his work was restricted—*by order*. He did, so far as he could, remark upon the species of what were, to him, borderlands, and are to us as naturally parts of British India as Madras and Bombay. But Ceylon, Burma, the Malay Peninsula, and much of his Afghanistan and Beluchistan are now parts of British India.

Hence, rather than from any failure of his or his predecessor's

and colleagues, arises the enormous increase in number of species now before us.

It will be remarked that in North-western India the increase is chiefly in migratory Palæarctic birds. On the Malayan side, *per contra*, it is, necessarily, in tropical forms. It is to be regretted that this work is by no means calculated to take the place of Jerdon's. Mr. Blanford's (or perhaps the Secretary of State's) compressing apparatus has been at work; and the present volume is very little more than a Museum Catalogue of dried skins. That Mr. Oates and Mr. Blanford can do better than this we know (many of us by personal intercourse), and the waste of the opportunity now offered is the more to be regretted.

The classification is no doubt very scientific; but the catalogues of the British Museum are good enough for ours, and Mr. Bowdler Sharpe, of the same, is rather "down" on our author for confusing a "key" with a "classification," and wants to know where the editor was when this was done? Mr. Sharpe, indeed, mingles blessings with his objurgations, and thinks that the present period of Indian Ornithology will be known as the "Oatesian Era," wherein Mr. Sharpe is very widely astray. The period when one man could name an era in Indian Ornithology is over.

Messrs. Blanford and Oates have indeed given us half a stone where we asked for bread. But they have not, in the language of the turf, given us "a stone and a beating." While they have been pottering over their list of the skins in the British Museum, the Bombay Education Society has brought out Mr. James Murray's Avifauna of British India.

It is first in the field to replace Jerdon's admirable, but now obsolete work. In the important matter of illustration, it is far superior to what we have, as yet, of Mr. Oates's book. Like that, it is too much of a mere catalogue; but the fault is much less in the Indian work, and, upon the whole, the present writer considers it much the fitter book of the two for district use.

It may, perhaps, be added that whereas the volumes, as yet apparent, of the Secretary of State's Fauna have been published under great patronage, the Avifauna of India has been carried through in spite of poverty and what might almost be called persecution; and

its appearance in print at all is the work of this Presidency or of some people in it.

It may now, however, on merely utilitarian grounds, be recommended to such members of the Society as may want a modern Ornithology of India, and not care to wait for Messrs. Blanford and Oates's very doubtful next issue.

Kolaba, May 1890.

W. F. SINCLAIR.

MISCELLANEOUS.

SECOND NOTE ON LOCUSTS IN INDIA.

IN November last a short preliminary note on locusts in India was issued with a view to showing briefly what was known on the subject, and indicating the points to which attention should be directed during the locust invasion which had then commenced in North-West India. In response to this appeal a considerable amount of information has reached the Indian Museum for incorporation in the general detailed report which is in progress. The materials, however, for anything like a complete account are still very deficient, and as there seems every probability of the locust invasion continuing through another season, this second note has been written with a view of indicating what has already been ascertained, and hence of showing the points on which further information is desired.

The locusts have now spread themselves over Sind, Rajputana, the Punjab, North-West Provinces and Oudh, besides penetrating sporadically into Guzerat, Ahmedabad, Baroda, Kandesh, and parts of Central India, and appearing in the Kistna district of the Madras Presidency. They have done a considerable amount of injury to standing crops, especially in Rajputana and Sind. Specimens have been forwarded (*) to the Indian Museum, from Karachi, Marwar, Jeypore, Ajmere, Merwara Mooltan, Naini Tal, Rawalpindi, Kistna, Etawah, Muzaffargarh, Lahore, and Bahrach ; they all prove to belong to the species *Acridium peregrinum*, (†) which is said to range throughout all the dry country extending from Algeria

(*) Through the kindness of Mr. W. D. Cumming, Surgeon-Major Hendley, Colonel G. H. Trevor, Mr. C. F. Elliot, Dr. William King, the Deputy Commissioner, Rawalpindi, the Superintendent of the Government Central Museum, Madras, the Collector of Etawah, the Director of Land Records and Agriculture, Punjab, the Superintendent, (?) School of Art, Lahore, and the Deputy Commissioner of Bahrach, respectively.

(†) To prevent the possibility of error in the determination of the species, specimens have been submitted to the two well known Entomologists, Dr. Henri de Saussure and Mr. W. F. Kirby ; these two gentlemen have most kindly examined them and agree in considering that they belong to the species *Acridium peregrinum*.

on the west to North-West India on the east(*). It has often proved most destructive in Algeria and has generally been supposed to be the *locust* of the Bible: but it must not be confounded, either with the locust which has appeared in Algeria during the past three years (1887, 1888, and 1889), and which belongs to the species *Stenopanotus maroccanus*, or with the locust which invaded the Deccan in 1882-83, though the latter insect was often erroneously referred to as *Acridium peregrinum*(†).

Flights of locusts appeared in June 1889 in Sind, and by September had spread over the whole province, from Shikarpur to Karachi. In the beginning of August young locusts were observed by Surgeon-Major Hendley in Marwar, between Didwana and Sambhur; these had, no doubt, hatched from eggs laid by winged swarms about the end of June, and therefore show that winged swarms were present in Marwar about the same time that they appeared in Sind. In September flights appeared first in Mooltan and afterwards in Dehra Ismail Khan; they were also found in Ulwar, Kishengurh, Jeypore, Sirohi, and in Ahmedabad. (‡) In October, besides maintaining themselves throughout Sind, Rajputana, Mooltan, and Ahmedabad, they penetrated south into Baroda and Khandesh. In November they reached, on the South-West Guzerat, and on the North-East Banda, Jhansi, Agra, Cawnpore, Etawah, Bareilly, and Bahrach. During December they continued to spread over the North-West Provinces, reaching Rae Bareilly, Fatehgarh, and Naini Tal; they also penetrated southwards as far as the Goona Agency in Central India, besides being reported from Rajputana as before. In January 1890, flights were reported from Lahore, Muzaffargarh, Rawalpindi, Ferozepur.

(*) Locusts passed over the British India Steam Navigation ship *Golconda* on November 25th, 1889, when off the great Hamish Islands in southern portion of the Red Sea (*Nature*). Also over the Peninsular and Oriental ship *Clyde* about the same time. They were noticed to be reddish in colour, and consequently likely to have been *Acridium peregrinum*. In 1869, also, the year of a great invasion in Rajputana of a locust which was probably *Acridium peregrinum*, locusts were noticed in great numbers in the Red Sea (Swinhoe). It would, therefore, be interesting to ascertain to what extent 1889 and 1869 were years of locust invasion in the intervening countries of Arabia, Persia, Baluchistan, &c.

(†) It is particularly necessary to distinguish carefully between the Deccan locust of 1882-83 and the Rajputana locust of 1889, as there are important differences in habits of the two species which make it that measures applicable for the destruction of the one are not always suited to the other.

(‡) Locusts were reported from Ahmedabad as early as July; it is doubtful, however, whether the first that appeared belong to the migratory swarms of *Acridium peregrinum*; no specimens have been obtained for examination, but specimens that were forwarded, as the locust which did injury to crops in Kathiawar in August, proved on examination to belong to a species which has been determined by Dr. Henri de Saussure as *Hieroglyphus colesiana* (de Saussure); this insect is totally distinct from *Acridium peregrinum* and is thought to be of purely local origin.

and also from the Kistna district in the Madras Presidency. Their presence was also noticed in Sind, but no mention was made of them in reports from Rajputana. In February they were again reported from different parts of the Punjab (Lahore, Rawalpindi, Dehra Ismail Khan) and also from Sind.

The above sketch of the spreading of the locusts seems to point to the sandy tracts of Western Rajputana as the centre from which they radiated. This being the tract from which it was supposed that the locusts came in 1869, when Rajputana was invaded by what appears likely to have been the same species of insect, and the fact that *Acridium peregrinum* periodically invades Algeria, from the direction of the Sahara desert, increases the probability of the supposition.

Wingless larvae have been received from Marwar, where they were found by Surgeon-Major Hendley in the beginning of August, and also from Jodhpore and Karachi, the dates of their capture not having been recorded; a specimen, however, said to have just emerged from the wingless state was received from Karachi, where it had been found by Mr. Cumming on 2nd November. These data, incomplete as they are, point to the invading flights of locusts having reached, on the one side Sind and on the other Jodhpore and Marwar, before depositing their eggs in June and July. Soon after this latter date the parent locusts no doubt died off, according to the known habits of their species, leaving the young locusts to develop; we accordingly find a lull until about September, in which month the earliest broods appear to have become full grown, acquired wings, and commenced to spread in flights. These flights seem to have gradually travelled northwards into the Punjab, and eastwards and southwards, across the Aravalli mountains into Eastern Rajputana, Central India, the North-West Provinces, Oudh, Khandesh, and Baroda, a stray flight penetrating even as far as the Kistna district in the Madras Presidency. They have flown backwards and forwards over this vast area in swarms which have alighted at intervals to devour the crops which they generally completely destroy where they alight, though their numbers have been too small to create any widespread calamity.

With regard to the future history of the locusts, the known habits of these interesting creatures enables us to predict with considerable certainty at least the general lines on which they will proceed. The flights of winged insects, now present in many parts of India, will probably continue during the remainder of the cold weather flying about the country and alighting at intervals to devour crops. They are, however, except in such sandy tracts as those which extend from the Araval mountains on the east to Sind on the west, under unnatural conditions, and may therefore be expected to perish in great numbers, from disease and the attack of their innumerable foes, before their time comes in the spring to deposit their eggs and die of old age, after completing the natural cycle of their existence. In their desert home they would probably not commence laying their eggs before May or June next, when their instinct told them that the time for vegetable growth was approaching; but under the damper conditions of the districts they

have now invaded, there is every probability that they will commence ovipositing very much earlier than this date. It is impossible to predict the date with any degree of certainty, but March and April are likely, at least in many cases, to see a large number of eggs are deposited. After the eggs are deposited the parent locusts will soon die off and the fate of the young locusts will, to a great extent, depend on the atmospheric conditions that obtain. They will undoubtedly be less healthy than their parents, and will probably be afflicted by all manner of diseases and parasites, whose history it will be most interesting and instructive to observe. If the year is an exceptionally dry one, they may succeed in passing through their various stages in numbers sufficiently vast to do an indefinite amount of injury both in their larval, and winged stages, but under ordinary condition it is to be expected that the vast bulk of them will die off before acquiring wings though injury may be done by them, in their earlier wingless condition.

An account of the remedies applicable to these locusts was given in the first note, and subsequent enquiry has only confirmed the statement there made that the best time to attack them is in the wingless condition, in which they emerge from the eggs, and long before they have acquired wings. They are then little black, helpless creatures which band themselves together and can readily be driven like sheep—into pits, or any other kind of trap prepared to receive them. The Cyprus system of screens and pits (described in the first note), could probably be utilised with advantage, but the prospects of serious injury from the locusts are not sufficiently alarming to make it probable that it will be considered advisable to go to any very considerable expense in introducing apparatus of the kind.

Amongst the points to which the writer would now direct attention, and upon which he will be grateful for any information, are the following :—

- (1) the ovipositing which is likely to take place within the next one or two months ;
- (2) the diseases, parasites, and other foes, to whose inroads the locusts will now be especially exposed ;
- (3) any emigration of fresh flights from Western Rajputana, or Baluchistan or the Suliman range.

With regard to No. 2 very little is at present known in India. The question of disease is very intimately connected with climatic conditions, for unfavourable, and especially wet, weather undoubtedly tends to produce an unhealthy condition in the locust. In the Bombay Presidency in 1883, however, the general debility observed in the locusts would seem to point to some specific disease, and the discoveries made of late years concerning contagious diseases amongst insects, due to the growth of low vegetable organisms in their tissues, render it extremely probable that the excessive mortality amongst the locusts will be due largely to some such cause. In support of this theory, besides instancing such well known insect diseases as pebrine, and muscardine, which are often most fatal to silkworms

it may be useful to notice the fungi, *Isaria destructor*, Mets., and *Isaria ophio-glossoides*, Kras., which are stated by Küneckel d'Herculais to have caused the total destruction of the eggs of the migratory locust *Pachytylus migratorius*, over large areas in South Russia in 1884, when the fungus was investigated and artificially cultivated by two Russian naturalists Metschnikoff and Krassilstchick. In this connection, it should be observed that great care is necessary in investigating the subject of zymotic diseases amongst insects: vegetable organisms found in the tissues of dead insects being sometimes of purely *post mortem* origin.

With regard to the parasites and insectivorous animals, which are supposed to account for much of the mortality amongst locusts in India, little has been ascertained; but the observations made on locusts in other parts of the world leave small doubt as to the nature of the numerous agencies that are at work. In the United States, according to Riley, the Rocky Mountain locust (*Caloptenus spretus*) is largely kept down by insectivorous animals and parasites, some of the most effective of which are themselves insects. Riley found that besides being devoured by vertebrate animals, such as pigs, poultry and other birds, toads, frogs, snakes, &c., and by the larger predaceous insects, such as Carabid and Cicindelid beetles, Asilid flies, some species of Scutelleridae (soldier bugs), and Mantidae, the eggs of the locusts, are parasitized by a Dipterous insect (*Anthomyia angustifrons*), which is estimated to destroy as much as 10 per cent. of them, by a little scarlet mite, and by an Ichneumon fly; while, after the locust emerges from the egg, it is parasitized by a mite (*Astoma gryllaria*), which attaches itself to its body and sucks its juices, and by various Tachinidae and Ichneumonidae, whose grubs develop in its tissues and thereby cause its death. Stolt observed that the locust (*Acridium peregrinum*) in Central America, was much infested by a parasitic *Mermis* (hair worm), which was present in six out of the ten specimens he dissected. While Küneckel d'Herculais states that in Russia it has been observed that Nematode worms pierce the locust egg cases and penetrate into the eggs which they destroy. In India little has been recorded beyond the fact that in the Bombay invasion of 1882-83 kites and crows fed upon the locusts, and that the presence was observed of two species of parasites, viz., "small red parasites," which were observed clinging to the bodies of the locusts, and which are likely to have been mites, allied to the *Astoma gryllaria* of America, and a "hair worm," which was reported to kill the locusts, no further particulars about it however being given, though it would seem likely to be a Nematode, allied to those observed in Russia and Central America.

E. C. COTES,

The 21st February 1890.

Indian Museum, Calcutta.

A MANUAL OF FORESTRY.*

Professor Schlieb's new Manual of Forestry will probably form the standard work for the instruction of Indian Forest Officers. In the interest of science,

* This letter appeared in the *Bombay Gazette* on the 20th March 1890.

I therefore beg leave to point out a few errors and omissions in the scientific part of the first volume, which may be of minor importance for the practical forester, but would certainly lead to a serious misconception of the physiological facts on which all culture of plants is based :—

In Part II., Chapter 1, under "Atmospheric Air," the author having stated the proportion of nitrogen and oxygen, writes :—"No chemical process is required to separate one constituent from another ; as a matter of fact, all porous bodies possess the faculty of taking oxygen from the atmosphere, without entering into a chemical combination with it. Amongst such bodies are the soil and the leaves of plants. Whether nitrogen is similarly taken up has not yet been proved, but further investigation may lead to important discoveries in this respect, as it is unlikely that the large store of nitrogen should only serve as a dilution of the oxygen.

This statement is entirely erroneous : as a matter of fact the two gases, though only forming a mechanical mixture, cannot be entirely separated, except by a chemical process, and only to a very small extent by mechanical means as by dilution in water, which is capable of dissolving proportionately more oxygen than nitrogen, or by allowing air to pass through an india-rubber membrane, in which case oxygen passes quicker than nitrogen, owing to the condensing power of india-rubber, which is greater in relation to oxygen than to nitrogen. Porous bodies take up the nitrogen as well as the oxygen, and except where a chemical process or combustion takes place and the oxygen combines with other substances, as in the case of leaves, and frequently in soil, it is only exceptional if ever oxygen is mechanically absorbed in greater proportion than nitrogen. The author proceeds to say : "Although the leaves of plants take up oxygen during the night and in the shade, they exhale greater quantities of it under the effect of light," &c. This is but partly correct, as the plants constantly, even in the fullest light, inhale oxygen, exhale carbon dioxide, and breathe just like animals, but this vital action, essential for the preservation of life, is, during the day, through the influence of light, partly obscured by the powerful decomposition of carbon dioxide, by which process carbon is assimilated and oxygen returned to the air. (Though the plants may at times show no outward sign of absorbing oxygen, there is now no longer any doubt that a sufficient amount of free oxygen is always available for combustion between the molecules of the cells, which enables the plants to live a certain time without the access of oxygen, just as it has been proved to be the case with frogs, &c.)

Under the heading "Carbon Dioxide," the author states :—"Plants take the great bulk of the carbon dioxide, which they require, through their leaves, from the atmosphere, only a comparatively small portion is taken up through the roots." The fact is that as just stated the green plants only absorb carbon from the carbon dioxide and return the oxygen. The oxygen necessary for forming carbonates is taken partly as oxygen from the air, and partly from water and mineral salt. A certain amount of carbon dioxide is taken up by the roots in water and carbonates, but is not assimilated. Parasites and fungi only take up previously assimilated carbon from their food-plants or from decaying organic matter.

Under the heading "Ammonia and Hydrogen Nitrate," the author states that it has not yet been ascertained how the necessary quantity, besides the contents of the annual rainfall, is obtained. There is, however, no doubt, that the soil always contains a sufficient quantity of ammonia-salts and nitrates to account for the nitrogenous matter found in plants, and it has been proved that with the exception of fungi (and perhaps other parasites) no plants are capable of assimilating the atmospheric nitrogen or ammonia.*

It might have been desirable in a book of this scope, to give a short outline of the movement of water in plants, the more so as this process has not been ascertained until comparatively recently after having for many years remained an unsolved and much disputed problem.

It must be regretted that a book which deals with its subject in such an admirably clear and demonstrative way, and is full of valuable information, should contain those few, but scientifically important errors.

Victoria Gardens.

G. CARSTENSEN.

MR. GILES' DRAGON-FLY.

WITH reference to a note by E. Giles in No. 8, Vol. IV. of the Journal, I would point out that Mr. Giles is almost certainly wrong in calling his insect a "dragon-fly." I do not know much of the neuroptera, but such a feat as he ascribes to a "dragon-fly" could not, I think, possibly be performed by one. The scene described, however, is very much what occurs each time *Chlorion* (a genus of the Sphex family of Fossiliferous Hymenoptera) has occasion to lay an egg. The cricket is paralyzed by stinging, and then buried to serve as food for the larva of *Chlorion*, when it shall hatch from the egg buried with the cricket. There are two fairly common species, *C. splendidum* (Fabr.) and *C. lobatum* (Fabr.), the latter, I think, is Mr. Giles' "dragon-fly." Dahlbom describes it as "*cyaneo-viride aut veride-cyaneum splendidissimum* ; St. Fargean calls it "*verte dorée*." Smith, however, in his Brit. Mus. Catalogue writes: "An examination of a large number of specimens from various parts of India and China shows that this insect is very inconstant in colour, varying from brassy or golden green to dark blue. This satisfies Mr. Giles' description, and *Chlorion* has certainly a far "neater figure" than any "dragon-fly." The only difficulty is the size. Unfortunately none of the authors quoted give the size; but $1\frac{1}{2}$ inches is, I should think, the average for *C. lobatum*.

Specimens of both *C. splendidum* and *C. lobatum* will be found in the Society's collection of Hymenoptera (Sphegidae, Nos. 16 and 17).

Poona Districts, 24th March 1890.

ROBT. WROUGHTON.

* According to the latest researches, it seems certain that some Leguminous plants chiefly kinds with warty roots, assimilate nitrogen from the air, probably through the agency of Bacteria

MEASUREMENTS OF A BOAR.

THE following measurements of a boar may interest the readers of the Journal. The animal was speared (with the Nagpore Hunt) by Mr. Burlson, of the 2nd Madras Lancers, on the 1st January 1890 :—

Height	...	...	...	...	...	38"
Girth	...	...	...	...	...	55"
Length	...	...	...	...	...	60"
Weight	...	...	...	...	...	350 lbs.
Tusks	...	...	...	...	...	8½"

The weight seems immense.

W. ST. JOHN RICHARDSON,

Bombay, 30th January 1890.

Captain, B. S. C.

TIGER CUBS.

It may perhaps interest the readers of the Journal to know that on the 21st instant, I took from inside a tigress, which I shot, five fully-formed young ones. They were rather smaller than newly-born fox-terrier puppies: three were males, two were females.

Mr. C. F. Pinney, of the Rifle Brigade, saw them at the time, and can corroborate what I write.

W. ST. JOHN RICHARDSON,

Bombay, 26th May 1890.

Capt. B. S. C.

SNIPE SITTING IN THE OPEN.

Mr. Sinclair, in the last issue of the Journal, noted an instance of snipe sitting in the open. During the past cold weather I found them running about like sand-pipers on these occasions. Once on the edge of a jheel where they had plenty of cover, I saw 6 or 8 on the ground, and twice on the brink of village ponds I saw single birds feeding. In 1884 I witnessed a similar departure from their usual habits near Sialkote, and in 1876 near Secunderabad I came across a large wisp running about a newly-ploughed paddy-field. The latter were, if I remember right, "pintails"; all those seen on this side of India are "fantails."

G. J. RAYMENT,

Babugarh, N.-W. P., 20th May 1890.

A. V. D.

PANTHERS TREE'D BY WILD DOGS.

ON the morning of the 25th March, as my friend C— and I were shooting small game along the bank of the Gogra river in the Neelghal, Berar, a native shouted, "Bagh hai, Sahib; Bagh hai;" so we went up to him. In a bend of the river, in a tree on a very high bank on the opposite side, was something black, and there were animals moving below.

Binoculars at once cleared the vision. There were two panthers in a "Sallai" tree, one above the other, with a large pack of 10 or 12 couple of jungle dogs moving about below.

The upper panther was resting across a branch, and the lower one holding on

perpendicularly. The difficulty was to approach. It was arranged that C— should go above and have the shot, while I went below. After a bit the lower panther made a jump, pursued by the pack in my direction on the bank, but he broke up a ravine. Just then C— shot the other panther dead, but he stuck in a lower fork when he fell. Some of the pack immediately came back and could be seen standing on their hind legs and licking the blood as it streamed from the beast out of reach.

My friend C— would have shot two dogs, but he had a miss-fire. I only got two or three long shots at the dogs. The panther shot was a fine male about 7' in length. The dogs made off, and we could not find the other panther.

Our informers said they saw the panthers treed at sunrise, and it was about 8 o'clock when we got there. This being the first instance I have known such a thing occur, I record it, as it will be interesting to sportsmen.

Chickalda, Berars, April 1890.

FRED. WRIGHT.

PROCEEDINGS.

PROCEEDINGS OF THE MEETING HELD ON 31ST MARCH 1890.

The usual monthly meeting of the members of this Society took place on Monday, the 31st March, Dr. D. MacDonald presiding.

The following new members were elected:—Colonel E. Carrington of Poona, Raja Marli Monohur Bahadar, Mr. Maneckjee Cursctjee, Mr. Manekshah Jehangirshah Taleyarkhan, and Mr. Venakrao Luxumunjee.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions:—

CONTRIBUTIONS DURING FEBRUARY AND MARCH.

Contributions.	Description.	Contributors.
1 Snake	Dipsas gokoel	Mr. G. Scaramanga.
1 Pallas' Shore Plover with 9 eggs.	C. mongolicus	Major J. H. Yule, R.A
1 Hodgson's partridge with 12 eggs...	Perdix Hodgsoniae	Do.
Head of Thibetan Gazelle...	Gazella picticundata	Do.
1 Cobra (alive)	Naga tripudians	Rev. Fr. Dreckmann, S.J
1 Phoorsa (alive)	Echis carinata.....	Mr. O. Meyer.
2 Snakes (alive)	Passerina myctericina	Do.
2 Dhamans(alive)	Ptyas mucosus	Do.
1 Mocking Bird (alive)....	.....	Mr. C. H. Byrne.
1 Peacock	Pavo cristatus	Mr. Ameerudin Tyabji
Eggs of painted partridge...	Francolinus pictus	Captain Shapland.
Nest of Palm Swift	Cypselurus batassiensis	Mr. H. F. Hatch.
1 Snake (alive)	Lycodon aulicus	Mr. M. C. Turner
1 Skimmer.....	Rhynchosops albicollis	Mr. E. L. Barton
Mineralogical specimens ...	From Worli	Mr. I. Benjamin.
A number of Snakes, Lizards, Rats, &c.....	From Raipore, G.P.....	Mr. J. A. Betham.

CONTRIBUTIONS TO THE LIBRARY.

“Bulletin de la Société Zoologique de France,—pour l'année 1889-90,” in exchange.

“New Commercial Plants” (Christy's) Nos. 2 to 6, presented by Mr. T. Lidbetter.

“The Indian Forester,” Nos. 9 to 12, in exchange.

“Birds of India” (Oates), interleaved copy, Vol. I, presented by Mr. W. F. Sinclair, C.S.

“Catalogue of the Insecta,” Part II, by E. T. Atkinson, presented by the author.

“Journal of Comparative Medicine,” Vol XI, No. 2., in exchange.

“Monograph of Oriental Cicadidæ,” by W. L. Distant, presented by the author.

“Records of the Geological Survey of India,” Vol. XXIII, Part I, in exchange.

“Notes on the Pearl and Chank Fisheries of the Gulf of Manaar,” presented by Edgar Thurston, the author.

“The proceedings of the Linnaean Society of New South Wales,” Vol. IV, Part III, in exchange.

ELECTION OF AN HONORARY CORRESPONDING MEMBER.

The Honorary Secretary read a letter from Mr. R. C. Wroughton of Poona, in which he stated that professor Forel, of Zürich, had been of the greatest use to this Society in identifying the specimens of ants and other Hymenopterons insects sent to him for that purposes. It was proposed, and carried unanimously, that Professor, Förel be elected an honorary corresponding member of this Society.

ACCOUNTS FOR 1889.

Mr. E. M. Slater, the Honorary Treasurer, then laid before the meeting a Statement of Accounts for the year ending 31st of December last, showing that the Society had a cash balance on that date of Rs. 1,932-8-10. It was resolved that the accounts be accepted, subject to the audit of Mr. John Wallace.

BRANCHING TREE FERNS.

The Honorary Secretary read a note by Mr. L. de Nicéville, of Calcutta, giving a description of a curiously bifurcated tree fern, which he had seen near Darjeeling.

DESTRUCTION OF THE PHURSA.

A letter was also read from Mr. R. E. Candy, C.S., Collector of Sholapore, containing an interesting account of his experiences when Collector of Rtnagherry, connected with the destruction of the Phursa (*Echis carinata*) in that district. Mr. Candy confirmed Mr. Vidal's recent statements on the subject, and strongly advised the Society to represent to Government the importance of destroying these dangerous snakes by adopting a more systematic system of reward.

Dr. J. C. Lisboa then read the first part of a valuable paper on Bombay Grasses, which appears in this number.

PROCEEDINGS OF THE MEETING ON 21ST APRIL 1890.

The usual Monthly Meeting of this Society took place on Monday, the 21st April 1890, Mr. E. M. Slater presiding.

The following new Members were elected :—

Mr. T. H. S. Biddulph, Mr. E. A. Bulkeley, Mr. E. G. Oliver, Capt. W. F. Biscoe, Col. R. M. B. Thomas, and Mr. A. Cooper.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions to the Society's collections :—

CONTRIBUTIONS DURING APRIL.

- 1 Snake, *Lycodon aulicus*, Mr. C. E. Kaue.
- 1 Phoorsa (alive), *Echis carinata*, Mr. B. W. Blood.
- Corallines from Prince's Dock, Mr. W. F. Lowe.
- 2 Peacocks (alive), *Pavo cristatus*, Mr. W. Hardie.
- 8 Crocodile's Eggs, *Crocodilus palustris*, Mr. R. P. W. Strong.
- A number of snakes and reptiles, from Simla, Mr. A. Newnham.
- 1 Scorpion, ten inches in length, Col. Thomas.
- 1 Owl (alive) *Strix javanica*, Mr. W. A. Menesse.
- 1 Flying squirrel, *Pteromys oral*, Mr. C. B. Collings.
- 1 Snake, *Simotes russelli*, Mr. F. Otto.
- Some geological specimens from Karli, Mr. I. Benjamin.
- 1 Large wasp's nest from Gadawara, C. P., Mr. F. A. G. Simpson.

CONTRIBUTIONS TO THE LIBRARY.

- “Silkworms in India,” by E. C. Cotes, presented by the author.
- A list of Irish birds in the Dublin Museum, from Mr. W. F. Sinclair, C.S.
- The *Punjab Magazine*, No. 23, in exchange.
- “Atlas of Practical Elementary Biology,” from Mr. T. B. Kirkham.

A NEW FUNGUS.

The Honorary Secretary read a valuable communication from Dr. Barclay, of Simla, describing a new species of fungus (*Accidium Esculentum*—Nov. Sp.), found by Mr. Robert Wroughton, of Poona, growing on *Acacia eburnea*, Willd. A note by Dr. Prain on the same fungus was also read, and it was decided that the two papers should be published in the Society's Journal with the illustrations furnished by these gentlemen. Mr. J. H. Steel, A. V. D., then read the following paper entitled

POPULAR LESSONS FROM THE BOMBAY HORSE AND CATTLE SHOW, 1890.

Now that the rush and hurry of the Show itself is over and the animals have returned to their homes, it may not come amiss if we review the events of the Show and examine the exhibits with a view to determine what outcome, if any, there has been of the trouble and exertions necessary for carrying out such a Show.

We may pass by, as not needing further notice here, the satisfactory fact that the Princes and Chiefs of Western India conspicuously demonstrated their loyalty to the Queen-Empress by going to the expense, trouble, and risk of sending valuable animals to be exhibited on the occasion of Prince Albert Victor's visit; also the gratification which the Municipality must have derived from the undoubted success of its Victoria Gardens entertainment (which success we may fairly claim depended largely on the Horse and Cattle Show); also the satisfaction which all worthy citizens of Bombay must feel at what was practically the first horse and cattle show of this city, having

been worthy of the *urbs prima*. What we want now is to examine the popular lessons of the Show ; to see what benefit of a permanent nature the Bombay people have derived from it ; the respects in which it has proved of educational value, and so has produced more influence than it could by the mere passing effect of pleasurable excitement and interest which it will have been to many.

A large proportion of the Bombay public had never seen a horse show, much less a cattle show ; another proportion had never seen either a horse or cattle show in India ; a few had seen the horse shows of the various parts of this Presidency, especially Poona and Ahmedabad ; a very few had seen horse and cattle shows held locally, as in the Southern Mahratta States (Chinchli), in Guzerat, Kattywar, and elsewhere. Now the Bombay Show had a distinct and special object—" to collect as many of the best animals in India, horses and cattle, as may be procurable for the purpose of showing them to the Prince." There resulted from the efforts of the committee an assemblage of animals from several places, the outlying posts being Lus Beyla in Beloochistan, Bikanir and Kotah in Rajputana, Hissar in the Punjab, Bhadgaon in Khandeish, Hyderabad and Sholapore in the Deccan, and the Southern Mahratta States down south. No less than twenty ruling Princes and Chiefs of Western India sent animals to the Show. Though the Exhibition was thus very representative of Western India, the committee had reason to believe that, had more time been available, the whole of India might have been represented. Practically efforts were limited to one month before the Show, owing to uncertainty as to the exact form the reception of his Royal Highness should take. Let us represent in tabular form what we saw at the Show and what we might have seen :—

HORSES.

Source.	Seen.	Not seen.
European	English T. B. N. T. Cobs	
Imported	Hunters	
	Hungarian and Blunts Arab....	
	Walers and New Zealanders, Arabs and Persian Kash- gans.	
Indigenous.....	Beluchi	Capes, Northerns, Cabulees.
	Cutchi	
	Kattywari.....	
	Bhimaturres	
	Kolhapore C.-B's.....	
	S. Mahratta C.-B's	
	Burmah.....	
Cross-breds	Arabs out of Kattywarris .. Walers .. C-B's ..	
	N. T. E. out of Cutchi	
	Arab out of Cutchi out of Deccani ..	
	Kattywari out of Deccani	
	T. B. E. out of Cutchi Kattywari.....	

CATTLE.

Source.	Seen.	Not seen.
European	English polled Angus Bull ...	Short horn and other breeds.
Imported	Austrian Cow	Cows of various breeds.
Indigenous.....	Beluchi	Other European breeds.
	Kankreji	Aden Cows.
	Gir or Kattywari.....	Sindi.
	Guzerathi...	Nellore.
	Mysori	Danghi.
	Bhadgaon Khilari	Punganur.
	Krishna Valley	Kuneverya(?)
	Deccani.....	Goranea(?)
	Wadias	Burmah.
	Gainias	Malwar.
	Hissar	Cauvery Valley.
	Guizerati out of Huryan.....	C. P. Cattle.
	English by Cutchi	Berars Cattle.
	Mysore by Deccani	
	Buffaloes Jaffarabadi	
	Delhi.....	
	Deccani.....	
	Soorti	
	Deshi.....	
Cross-breds		

Little Fram, Mr. Adenwalla's remarkable pony, which was commended as a curiosity, was said to have come from Australia and to have arrived there from Shetland, but there seemed a doubt as to his origin. He was practically full-grown, and contrasted remarkably with Mr. Heeramaneck's grey walers, for example. He was more probably a dwarf, representative of the ordinary race of horses, rather than one of a race of equine pygmies. His measurements were found to be fairly in proportion, though to a horseman's eye he was not handsome. The class of miscellaneous exhibits was improvised, as the exhibition of saddlery, harness, &c., fell through in the rush of organisation. In this class were placed the Rajah of Bikanir's camels, Little Fram, a dumb sheep, and a few other things, including the gorgeous horn-covers and trappings of a superb pair of bullocks sent up by H. H. the Gaekwar of Baroda. The educational benefits resulting from the Show have not been confined to those obtained by the general public. Exhibitors and their servants must have benefited by comparison of their animals with those from other parts of the country. Veterinary students have had a most valuable experience, and details have been collected which will be embodied in a scientific record of the Show. It will be seen that the breeds represented far outnumber those unrepresented, and there is every reason to believe that with a little more time many of the blanks, especially as regards cattle, might have been filled up. In some cases the sub-division into breeds went further than above indicated, and I am writing to our active coadjutor, Colonel Nutt, for favour of information concerning the terms applied in Kattywar and Northeru Guzerat to families of horses, cattle, and buffaloes, especially as regards the meaning of some terms inserted in the official catalogue, which to me are ob-

scure. Bombay may congratulate itself on having seen a most exceptional collection of indigenous and imported horses and cattle, also of cross-breeds, and on an opportunity for comparison of results of breeding operations in Western India, such as has not occurred before and will be long before it occurs again. People who talk in a light-hearted manner of animal shows in Bombay are hardly aware of the exceptional circumstances under which the 1890 Show has been organized, nor of the amount of work and responsibility involved in it. At any rate, some of the secretaries can look back on the week of the Show as the busiest in their lives.

Consideration of the awards shows that—

1. The general stamp of exhibits was of high class. 32 per cent. being rewarded.
2. The cattle were, as a whole, considered more highly than the horses, 38 per cent.
3. Of the horses and ponies, Bombay contributed roughly one-third; and of the cattle, about an equal proportion.
4. Bombay exhibits were a few Walers, a good show of Arab horses and ponies, some useful draught cattle, and some valuable buffalo-cows.
5. The Princes and Chiefs mainly exhibited in the European and country-bred classes of the horses in all classes of cattle.
6. From the northern parts represented in the Show, the horses principally obtained prizes.
7. From the southern parts represented in the Show, cattle principally obtained prizes.
8. The Government of India (Commissariat Department) and the Government, of Bombay took prizes for cattle.
9. A colt by a Bombay Government sire took first prize in the young stock class.
10. The driving classes (cattle) were a failure.
11. Bombay was well represented in the driving, jumping, and turn-out classes, showing that as regards horsemanship the Bombay people make the most of the time, space and climate at their disposal.
12. The Bombay Municipality was well represented in the bullock class.

On the whole, I take it, the Show was representative of Bombay as well as of the west of India. The Waler classes were weak, the Arab classes, country-bred, and young stock classes were necessarily dependent on supplies from up-country. As regards cattle, bullocks, buffaloes, cows, and gainias came from Bombay, breeding stock and agricultural bullocks from up-country. To the happy combination of classes from local and exterior source, must be attributed the general success of the Show. The weakness of the important cattle classes, and the cattle driving, were more than compensated for by the fine show of Arabs, country-breds, and ponies, the good muster of indigenous cows, bulls, bullocks, and buffaloes, and the enthusiasm in the horse driving and turn out classes—possibly a larger number of tandems and of jumping ponies might have turned up, but on the whole the entries were gratifying. There can be no doubt the Bombay public fully appreciated the novel sight of a horse and cattle show in the island, and in the main those who were concerned in its organization must be gratified with the result.

AN ALBUM OF THE PRIZE ANIMALS.

Mr. Steel informed those present that all the animals at the Show had been photographed, and that the pictures when bound together in an album, with printed descriptions, would form a most valuable means of comparing the different breed of horses and cattle.

The Chairman proposed a vote of thanks to Mr. Steel for his paper, and complimented him on the successful manner in which he and those who had worked with him had carried out the organization of the Show.

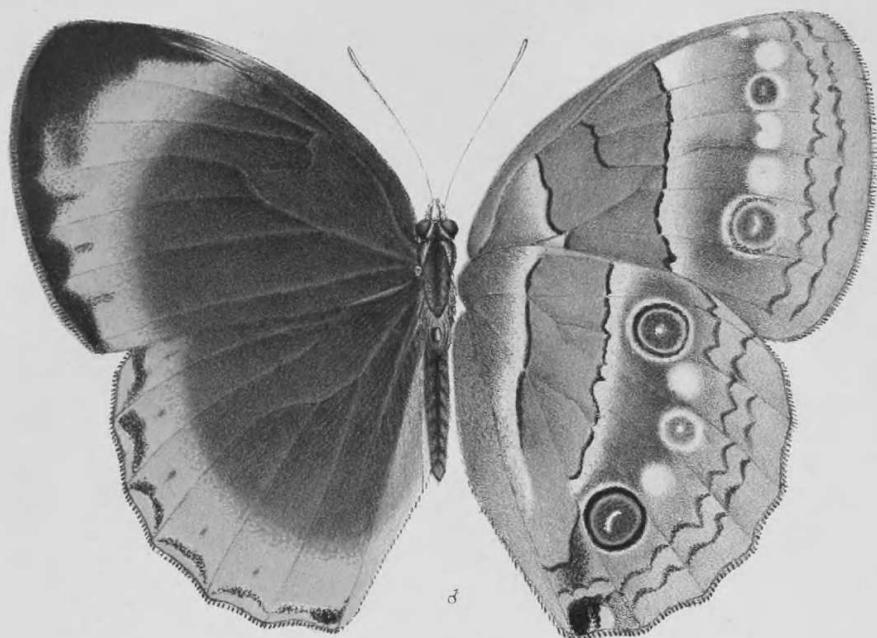


H.B. del.

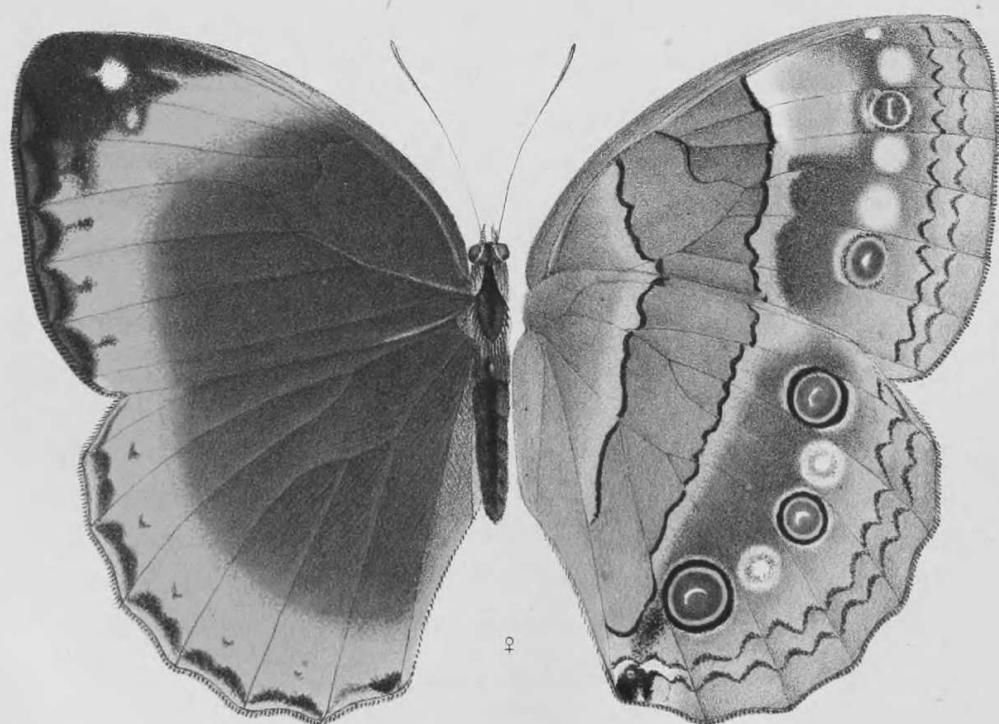
Mintern Bros. Chromo lith. London

631. *ZOSTEROPS PALPEBROSA*, Tem.

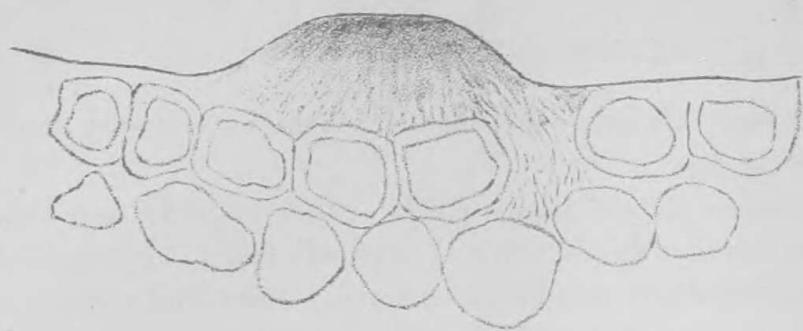
The White-eyed Tit.



♂



♀



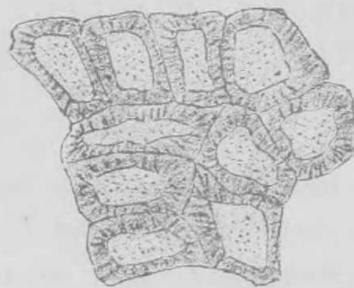
2 \times 350.



3 \times 150.



1 \times 350.



4 \times 350.



5 \times 350.



1



2



3